District Engineer: Maj. B. M. Harloe, Corps of Engineers, to July 22, 1935; Lt. Col. P. S. Reinecke, Corps of Engineers, since that date.

Division Engineer: Col. E. L. Daley, Corps of Engineers, to August 19, 1935; Col. J. N. Hodges, Corps of Engineers, since that date.

#### IMPROVEMENTS

<ol> <li>Mississippi River between the Ohio and Missouri Rivers</li> <li>Mississippi River between the Missouri River and Clarksville, Mo</li> <li>Missouri River between the mouth and Hermann, Mo</li> <li>Removing snags and wrecks from the Mississippi River below the mouth of the Missouri River, and from Old and Atchafalaya Rivers</li> </ol>	963 871 871 871	<ul> <li>5. Examinations, surveys, and contingencies (general)</li> <li>6. Plant allotment</li> <li>7. Upper Mississippi River, flood control</li> <li>8. Illinois and Des Plaines River Basin, flood control</li> </ul>	Page 874 875 876 877
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### 1. MISSISSIPPI RIVER BETWEEN THE OHIO AND MISSOURI RIVERS

Location.—The Mississippi River rises in Lake Itasca, Minn., flows in a southerly direction 2,440 miles, and empties into the Gulf of Mexico. The portion included in this report embraces the 195-mile section known as the middle Mississippi, between the tributary Ohio

and Missouri Rivers, 1,078 to 1,273 miles from the Gulf.

Previous projects.—The original project for the improvement of the Mississippi River between the Ohio and Missouri Rivers was recommended by a Board of Engineers in a report dated April 13, 1872, and concurred in by the Chief of Engineers. The cost and expenditures for the middle Mississippi prior to the adoption of the present project in 1881 were \$1,610,000 for new work.

(For further details see p. 1879 of the Annual Report for 1915.) Existing project .- This provides for obtaining and maintaining a minimum channel depth of not less than 9 feet, a minimum width of not less than 300 feet at low water, with additional width in bends from the mouth of the Ohio River (1,078 miles from the Gulf) to the northern boundary of the city of St. Louis, 191 miles; thence 200 feet wide, with additional width in bends to the mouth of the Missouri River, 4 miles, all to be obtained by regulating works and dredging,

First, by regulating works, for closing sloughs and secondary channels, and narrowing the river; by building new banks where the natural width is excessive and protecting new and old banks from erosion where necessary to secure permanency.

Second, by dredging or other temporary expedients to maintain

channels of project dimensions.

The project for regulating works was adopted in 1881 (Annual Report, 1881, p. 1536). Dredging was introduced as a part of the project by the River and Harbor Acts of 1896, 1902, 1907, and 1922, the latter of which provides for dredging channels to landing places on the main river and subsidiary sloughs for the river above the mouth of the Missouri River. That part of the project for the middle Mississippi which proposed regulating works was practically

abrogated by acts of March 3, 1905, March 2, 1907, and the joint resolution of June 29, 1906. The River and Harbor Act of June 25, 1910, restored regulating works to the project and began appropriations with a view to the completion of the improvement between the Ohio and Missouri Rivers within 12 years, at an estimated cost of \$21,000,000, exclusive of amounts previously expended (H. Doc. No. 50, with accompanying atlas, 61st Cong., 1st sess.; and H. Doc. No. 168, 58th (long., 2d sess.). The River and Harbor Act of January 21, 1927, provided for a depth of 9 feet and width of 300 feet from the Ohio River to the northern boundary of St. Louis and increased the estimate for maintenance to \$900,000 annually (Rivers and Harbors Committee Doc. No. 9, 69th Cong., 2d sess.). The River and Harbor Act of July 3, 1930, modified the project between the northern boundary of the city of St. Louis and Grafton (mouth of Illinois River) to provide for a channel 9 feet deep and generally 200 feet wide with additional width around bends, at an estimated cost of \$1,500,000, with \$125,000 annually for maintenance (Rivers and Harbors Committee Doc. No. 12, 70th Cong., 1st sess.).

The estimated cost of new work, revised in 1934, is \$43,000,000,

with \$1,300,000 for annual maintenance.

Terminal facilities.—The water terminal and transfer facilities of the district are fully described as of December 31, 1918, in House Document No. 652, Sixty-sixth Congress, second session, pages 1211-1239. Additional data for terminal facilities is also confained in Transportation Series No. 2, 1929, Transportation in the Mississippi

and Ohio Valleys,

Operations and results during fiscal year.—River stages were favorable to construction work, which was carried on extensively by hired labor with Government plant and by contract throughout the fall of 1935; river conditions were unfavorable during the early spring of 1936, mainly due to the extreme cold during the winter of 1935-36, which caused formation of heavy ice in the river from Memphis to the headwaters, the river freezing over in many places as far south as Cairo. Rivers within the districts were not clear of ice until early in March, when ice ran out on a medium high stage causing serious damage to piling dikes. Regulating works were maintained and project dimensions of channels were secured by dredging. The district's standard specifications for construction work were used. Location, quantities, and costs of regulating works follow:

Class of work and locality	Miles above	Dikes (hu		rdles)	
	of Ohio River	Number	Linear feet	Cost	
New work by contract: Goose Island.					
Olhanov Island-Carm Oleandani.	37 51	2 2	1, 800 1, 070	\$50, 996. 0	
Seventy Six-Cr., in Island Chester, III. Kaskaskia Island-Ste. Genevieve. Calleo Island-Sulphus Sorbos	97 115	5	1, 500 2, 390	10, 460, 74 36, 277, 90	
Alternative and the state of th	116 155	4 5	1, 500 2, 180	77, 838, 23 39, 310, 18 55, 569, 80	
Total	103	3	1, 920	74, 352, 09	
ow work by United States plant and hired labor:	Anny at State	25	12,480	352, 800, 98	
Oftoney Ishard. Wilkinson. Danky Landing.	50 85	1	700 330	13, 944, 80 5, 214, 29	
4.9000	144	i	205	22, 433, 06	
Maintenance by United States plant and hired labor		3	1, 295	41, 507, 15 137, 860, 26	

	Miles	Bank protection (revetments)					
Class of work and locality	above mouth of Ohlo River	Number	Linear feet bank	Squares (	100 square ot)	Costs	
			profeeted	Mattress	Paving		
New work by contract: Hurricane Field-Boston Bar Dogtooth Bond Price Landing Cape Girardeau Giboney Island-Cape Girardeau Giboney Island-Devils Island Devils Island Wilkinson Liberty Bend (Thebes Reach) Kaskaskia Island Pulitight Total Maintenance by United States plant and hired labor	23 30 49 48 59 69 02 100 115	(t) 1 1 1 1 (t) 1 1 1 1 1 0	550 1, 085 2, 515 1, 705 870 605 5, 230 815 1, 340 2, 400 1, 285	575 2,340 2,610 1,902 957 737 5,363 1,340 2,568 1,304 20,460	356 1, 341 777 411 482 1, 745 394 729 1, 473 82	70, 977, 45 35, 575, 02 21, 734, 82	

<sup>1</sup> Reported fiscal year 1935.

Regular funds.—The following new work was done with regular funds by hired labor with Government plant: Three dikes totaling 1,295 linear feet in length at a cost of \$41,597.15. The total cost of new work with regular funds was \$41,597.15.

The following maintenance work was conducted with regular funds. The required 9-foot channel was maintained, except for short periods needed to move a dredge to the shoal, by five United States dredges. During the year 33 shoals developed, of which 20 were dredged once, 6 were dredged twice, 5 were dredged three times, and 2 required dredging four times. There were 7,329,235 cubic yards of sand and gravel removed by United States dredges from channels through 20 bars, and 840,297 cubic yards of material removed in outside-the-channel dredging, 71.218 cubic yards of which was done for the Missouri Pacific Railroad at Little Rock Landing for which the district was reimbursed. The channels dredged had a combined length of 25 miles, an average width of 265 feet, and an average gain in depth of 5.5 feet. The total cost of dredging was \$395,786.68, all charged to maintenance.

Hydrographic surveys were made covering 422 miles of river. The cost of surveys was \$68,760.38, charged to maintenance. The

total cost of all maintenance was \$644,152.

Public Works funds-New work.—The following operations were conducted: Two dikes totaling 1,070 feet in length were built under contract at a cost of \$19,460.74; four revetments totaling 2,165 feet in length, consisting of 2,850 squares of mattress and 1,560 squares of paving, were built under contract at a cost of \$79,557.01. The total

cost. Public Works funds, was \$99,017.75, all new work.

Emergency Relief funds—New work.—The following work was done: Twenty-three dikes totaling 11,410 feet in length were built under contract at a cost of \$333,340.24; eight revetments totalling 16,895 feet in length, consisting of 18,100 squares of mattress and 6,785 squares of paving, were built under contract at a cost of \$331,154.97. The total cost, Emergency Relief funds was \$664,495.21, all new work. In addition to completed work there were under construction, by contract, two dikes to total 1,200 linear feet and five revetments to total

7,995 linear feet, all to be paid for with Emergency Relief funds. The costs and expenditures during the fiscal year were as follows:

Make may be a long to the second many many and the second management and the second management of the second management o				
Kind of funds				
	New work	Mainte- nance	Total	Expendi- tures
Regular , , Public Works ,	\$41, 597, 15 99, 017, 75 664, 495, 21	\$614, 152	\$685, 749, 16 99, 017, 75 664, 495, 21	\$368, 365, 13 115, 140, 60 639, 226, 83
Total	805, 110, 11	614, 152	1, 449, 262, 11	1, 123, 032, 56

Condition at end of fiscal year.—The regulating works are about 69 percent completed. The quantities required to complete the project are estimated as follows: 120 dikes, 90,000 linear feet, and 50 revetments, 263,000 linear feet. All revetments are in very good repair, but piling dikes suffered a loss of about 40,000 linear feet due to ice. However, the channel has been greatly improved by the work that has been done. Dredging is required at low stages to remove temporary shoals and maintain the required channel depths.

In recent years, notwithstanding the unusual low water that has prevailed, the project dimensions of channels have generally been maintained throughout the navigation season. The navigation season usually lasts from the early part of February to the latter part of December, the river being generally closed by ice the remainder of the year. The river is usually above the 10-foot stage, St. Louis gage, for 6 months of the year during which time the minimum channel depth generally prevails without dredging.

The following table gives condition of the channel:

Fiscal year 1936

Ange bernarie in a consideration and a conside	Length of section	Afford- ing less than 9 feet	Period	Afford- ing more than 9 feet	Period	Proposed low- water width	Control- ling depth
Mouth of Ohio to Commercial Point Commercial Point to Com- mores Commerce to Grays Point Grand Tower to Fort Gage Fort Gage to Little Rock Little Rock to River Des Peres. River Des Peres to northern boundary, city of St. Louis Northern boundary to mouth of Missouri River	Miles 32, 2 7, 2 6, 0 33, 5 36, 2 9, 5 46, 5 10, 0 4, 1	Miles 0. 5 7 5 4. 5 2. 0 2. 1 3. 1 4. 0	Days 34 13 25 53 50 28 45 62 53	Aftles 31, 7 0, 5 6, 4 20, 0 33, 3 7, 4 43, 4 15, 0 3, 0	Days 241 262 250 222 219 247 230 213 222	Fret 2,000 2,500 2,085 2,250 2,250 2,250 1,700 2,250	Feet 8 8 7 7 7 8 8 8 6 6

The total costs under the existing project to the end of the fiscal year are \$29,623,329.95, including \$25,496,680.28 regular funds, \$3,462,154.46 Public Works funds, and \$664,495.21 Emergency Relief funds for new work, and \$18,559,331.84, regular funds, for maintenance, including dredging and surveys, a total of \$48,182,661.79. The total expenditures on the existing project are \$48,062,047.54, of which

\$43,960,666.25 were regular funds, \$3,462,154.46 were Public Works funds, and \$639,226.83 were Emergency Relief funds.

Proposed operations.—The unexpended balance at the end of the year will be applied as follows:

Regular	funds
---------	-------

Regular funds	
Accounts payable, June 30, 1936New work:	
New work:	\$95, 345, 87
By contract, July 1, 1936, to June 30, 1937: Piling dikes:	
Hurricane Field-Cairo protection Price Landing Powers Island-Goose Island	
Price Landing	133, 840, 00
Powers Island-Goose Island Devils Island-Schenningn	55, 597, 00
Devils Island-Schonning	67, 193, 00
Willard-Hanging DogLiberty	112, 100, 00
Liberty Crain Island	109, 430, 00
Crain Televia	52, 202, 00
Kaskaskia Island-ChesterCalleo Island	40, 503, 00
Calico IslandRevetment, Devils Island	90, 000, 00
Revetment, Devils Island	106, 522, 00
Fig. 1	75, 000, 00
Total by contract	010 000 00
by fired labor with United States plant July 1 1939 to 1	840, 390, 00
30, 1937: Revetment, Price Landing	me
Total new work	044 200 00
Maintanance by the re-	044, 396, 00
Maintenance by hired labor with United States plant, July 1, 1936 to June 30, 1937;	
to June 30, 1937;	<b>'</b>
Dikes and revetments  Project channel dredging	KOO KOO OO
Project channel dredging Surveys, tests, and studies	520, 500, 00 964, 000, 00
Surveys, tests, and studies	110 000 00
Model tests	35 000 00
Total maintenanceUnallocated balance	1, 829 500 00
	980.04
Total regular funds	2007 (70)
Man called to the A. A.	2, 669, 511, 77
the fiscal year, will be applied as follows:	the end of
Accounts payable June 30, 1936	them are an
Now would be need to	\$20, 268, 38
New work: By contract (completion of existing contracts), July 1936 to June 30, 1937:	
DUo 40	
DUA -10	
Pile dikes;	
Pile dikes; Chester, III	- 49.000 GA
Pile dikes; Chester, III	- 40, 000, 0 <b>0</b>
Pile dikes; Chester, III Seventy Six-Crain Island Kaskaskia Island	- 40, 000, 0 <b>0</b>
Pile dikes; Chester, III	- 40, 000, 0 <b>0</b>
Pile dikes; Chester, III Seventy Six-Crain Island Kaskaskia Island-Ste. Genevieve Calico Island-Sulphur Springs Revetments; Durtooth Bond	- 40, 000, 00 - 20, 800, 00 - 45, 300, 00 - 28, 600, 00
Pile dikes; Chester, III Seventy Six-Crain Island Kaskaskia Island-Ste. Genevieve Calico Island-Sulphur Springs Revetments; Dogtooth Bend Liberty, III (Thebes Book)	- 40, 000, 00 - 20, 800, 00 - 45, 300, 00 - 28, 600, 00
Pile dikes; Chester, III Seventy Six-Crain Island Kaskaskia Island-Ste. Genevieve Calico Island-Sulphur Springs Revetments: Dogtooth Bend Liberty, III. (Thebes Reach)	- 40, 000, 00 - 20, 800, 00 - 45, 300, 00 - 28, 600, 00 - 48, 200, 00
Pile dikes; Chester, III Seventy Six-Crain Island Kaskaskia Island-Ste. Genevieve Calico Island-Sulphur Springs Revetments; Dogtooth Bend Liberty, III. (Thebes Reach) Cape Girardeau Wilkinson	- 40,000,00 - 20,800,00 - 45,300,00 - 28,600,00 - 48,200,00 - 11,200,00
Pile dikes; Chester, III_ Seventy Six-Crain Island_ Kaskaskia Island-Ste. Genevieve_ Calico Island-Sulphur Springs_ Revetments; Dogtooth Bend_ Liberty, III. (Thebes Reach)_ Cape Girardeau_ Wilkinson_ Kaskaskia Island	- 49, 000, 00 - 20, 800, 00 - 45, 300, 00 - 28, 600, 00 - 48, 200, 00 - 11, 200, 00 - 19, 400, 00
Pile dikes; Chester, III_ Seventy Six-Crain Island_ Kaskaskia Island-Ste. Genevieve_ Calico Island-Sulphur Springs_ Revetments; Dogtooth Bend_ Liberty, III. (Thebes Reach)_ Cape Girardeau_ Wilkinson_ Kaskaskia Island_ Ste. Genevieve	- 40, 000, 00 - 20, 800, 00 - 45, 300, 00 - 28, 600, 00 - 48, 200, 00 - 11, 200, 00 - 19, 400, 00 - 16, 900, 00 - 8, 800, 00
Pile dikes; Chester, III	40, 000, 00 20, 800, 00 45, 300, 00 28, 600, 00 48, 200, 00 11, 200, 00 19, 400, 00 16, 900, 00 20, 300, 00
Pile dikes; Chester, III	49, 000, 00 20, 800, 00 45, 300, 00 28, 600, 00 48, 200, 00 11, 200, 00 19, 400, 00 16, 900, 00 26, 300, 00 31, 000, 00
Pile dikes; Chester, III_ Seventy Six-Crain Island_ Kaskaskia Island-Ste. Genevieve_ Calleo Island-Sulphur Springs_ Revetments; Dogtooth Bend_ Liberty, Ill. (Thebes Reach)_ Cape Girardeau_ Wilkinson_ Kaskaskia Island_ Ste. Genevieve_ Pulltight_ Cabaret Island_	40, 000, 00 20, 800, 00 45, 300, 00 28, 600, 00 11, 200, 00 19, 400, 00 16, 900, 00 20, 300, 00 31, 000, 00 32, 300, 00
Pile dikes; Chester, III_ Seventy Six-Crain Island_ Kaskaskia Island-Ste. Genevieve_ Calico Island-Sulphur Springs_ Revetments; Dogtooth Bend_ Liberty, Ill. (Thebes Reach)_ Cape Girardeau_ Wilkinson_ Kaskaskia Island_ Ste. Genevieve_ Pulltight Cabaret Island	40, 000, 00 20, 800, 00 45, 300, 00 28, 600, 00 48, 200, 00 11, 200, 00 19, 400, 00 16, 900, 00 6, 300, 00 31, 000, 00 32, 300, 00
Pile dikes; Chester, III_ Seventy Six-Crain Island_ Kaskaskia Island-Ste. Genevieve_ Calico Island-Sulphur Springs_  Revetments: Dogtooth Bend_ Liberty, III. (Thebes Reach)_ Cape Girardeau_ Wilkinson_ Kaskaskia Island_ Ste. Genevieve_ Pulltight_ Cabaret Island_ Total new work_ Unallocated balance	40,000,00 20,800,00 45,300,00 28,600,00 48,200,00 11,200,00 19,400,00 16,900,00 6,800,00 20,300,00 31,000,00 32,300,00
Pile dikes; Chester, III_ Seventy Six-Crain Island_ Kaskaskia Island-Ste. Genevieve_ Calico Island-Sulphur Springs_  Revetments; Dogtooth Bend_ Liberty, III. (Thebes Reach)_ Cape Girardeau_ Wilkinson_ Kaskaskia Island_ Ste. Genevieve_ Pulltight_ Cabaret Island_ Total new work_ Unallocated balance	40,000,00 20,800,00 45,300,00 28,600,00 48,200,00 11,200,00 19,400,00 16,900,00 6,800,00 20,300,00 31,000,00 32,300,00
Pile dikes; Chester, III_ Seventy Six-Crain Island_ Kaskaskia Island-Ste. Genevieve_ Calico Island-Sulphur Springs  Revetments; Dogtooth Bend_ Liberty, III. (Thebes Reach)_ Cape Girardeau_ Wilkinson_ Kaskaskia Island_ Ste. Genevieve_ Pulltight Cabaret Island Total_new_work_	40,000,00 20,800,00 45,300,00 28,600,00 48,200,00 11,200,00 19,400,00 16,900,00 6,800,00 20,300,00 31,000,00 32,300,00

808 REPORT OF	CHIEF OF	F ENGINE	ERS, U. S.	ARMY, 1	936
The sum of \$2, fiscal year 1938 as	000 000				
New work;					
By contract, July Dikes Revetments					
Revetments By hired labor, Ju					\$500, 000
Dikes		•	1000.		
•				. <del>_</del>	1800 00
Total, new	work				1, 000, 000
Maintenance: By hire 1937, to June 30, 193 Dikes and revetm Project channel d Surveys, tests, and	ed labor w 8: ents	ith United	States pl	ant, July	1, 225, 000
					100 000
Total maintenar	10e				1, 000, 000
Total for all we	ork				2,000,000
It is expected that be 77 percent compl	. With the	proposed	expenditu	ires, the p	roject will
	Cost and	financial s	ummary		
MAI	NTENANCE .			T Page	
Cost of new work to J Cost of maintenance to	no +o.				, 106, 680, 28
Total cost of per Minus accounts payable				10,	000, 831, 84
Not total association	14			<del></del>	
Net total expend Unexpended balance Ju	mo 30, 193	6		45,	570, 666, 25
Total amount app	propriated t	o June 30,	1036	<u>2,</u> 48,	240, 178, 02
Fiscal year ending June 30		<del></del> _	<del>                                     </del>		
r acar year ending rung 30	1032	1933	1934	1935	1030
Post of new work Post of maintenance	\$1, 008, 610, 87 1, 120, 165, 37	\$2, 354, 097, 86 951, 859, 78	\$1, 277, 408, 17 1, 059, 616, 63	\$33, 347, 98 890, 974, 77	\$41, 597. 15
Total cost	2, 128, 776, 24	3, 305, 957, 64	2, 937, 084, 70	933, 322, 75	685, 749, 15
otta oxponitat	2, 701, 331, 23	3, 599, 802, 51	2, 906, 285, 24	- 1,962,932.93	
Allotted	269, 578, 67	5, 122, 994, 46	2, 243, 564, 23	-2,289,481.38	368, 365, 13 2, 304, 940, 52
Balance unexpended Ju Amount allotted from Wi Act approved Apr. 9, 1 Amount allotted from Wi Act approved May 15,	ur Departm 1935	ent Approp	\$2	25, 000 25, 000	732, 036,38
Amount to be acco Deductions on account of	unfed for				750, 000. 00
Deductions on account of	revocation	of allotme	nts	3, 4 4	82, 936, 38 45, 059, 48

						er 86
Net amount to be Gross amount expended	e accounted	for				3, 037, 876, 9
Less:				\$816,	958, 26	., ., ., ., .,
Reimbursements ( Receipts from sal	collected es	\$303, 145,	442. 40 148. 73			
		;		448,	591. 13	900 905 4
Balance unexpen	dod Inno 9	Ď 109a				368, 365, 1
Balance unexpen Outstanding Habilities Amount covered by ur	June 30, 19 icompleted	0, 1830 036 contracts_		\$95,	345, 87	2, 669, 511, 7
			-			766, 538. 4
Balance availabl	e June 30,	1936				1 (0)9 079 0
Amount (estimated) re of existing project 1_	e i Cambian					
Amount that can be a	w-01 11				1	2, 100, 000, 0
Amount that can be p June 30, 1938; For new work 1 For maintenance 1_						
For maintenance 1			~~~~~~			1,000,000,0 L000,000
Total 1						, out, wu. u
1 Exclusive of available	funds.				2	2, 000, 000, 00
	PUBLIC	WORKS FT	INDS			
Cost of new work to In	no 90 1000					
Cost of new work to Ju Cost of maintenance to Total cost of per	June 30, 1930	ga			\$3	, 462, 154, 40
		:) U			•	
Total cost of per	manent wo					~
Total cost of per Net total expenditures. Total amount appropriat	manent wo					~
Total cost of per Net total expenditures_ Total amount appropriat	manent wo					~
Net total expenditures. Total amount appropriat Fiscal year ending June 30	ed to June	30, 1936	1934	36	3 3 3	, 462, 154, 46 , 462, 154, 46 , 462, 154, 46
Net total expenditures. Total amount appropriat  Fiscal year ending June 30  Cost of new work.  Cost of maintenance.	ed to June	30, 1936	1934	36	3 3 3	, 462, 154, 46 , 462, 154, 46 , 462, 154, 46
Net total expenditures. Total amount appropriat  Fiscal year ending June 30  Cost of new work. Cost of maintenance  Potal expended.	ed to June	30, 1936	1034	36	3 3 1935	, 462, 154, 40 , 462, 154, 40 , 462, 154, 40 , 462, 154, 40 , 462, 154, 40
Net total expenditures. Total amount appropriat  Fiscal year ending June 30  Cost of new work. Cost of maintenance  Potal expended.	ed to June	30, 1936	1034	36	1935 \$560, 531, 20	1936 \$99,017.75
Net total expenditures. Total amount appropriat  Fiscal year ending June 30  Cost of new work. Cost of maintenance  Fotal expended  Milotted	1932	30, 1936	1034	36	3 3 1935	, 462, 154, 40 , 462, 154, 40 , 462, 154, 40 , 462, 154, 40 , 462, 154, 40
Net total expenditures. Total amount appropriat  Fiscal year ending June 30  Cost of new work. Cost of maintenance.  Potal expended.  Milotted.  Bulance unexpended July Deductions on account of	1932	of allotme	1934 \$2,802,605 2,819,258 2,917,380	36	3 3 1935 \$560, 531, 20 527, 465, 76 625, 000, 00	\$99,017.78 115,440.60 -80,226.01
Net total expenditures. Total amount appropriat  Fiscal year ending June 30  Cost of new work. Cost of maintenance  Potal expended.  Milotted  Balance unexpended July Deductions on account of Net amount to be a	1932  1, 1935 revocation	of allotme	1934 \$2,802,605 2,819,258 2,917,380	.11 .47	3 3 1935 \$500, 531, 20 527, 455, 75 625, 000, 00	\$99,017.78 115,440.60 -80,226.01
Net total expenditures. Total amount appropriat  Fiscal year ending June 30  Cost of new work. Cost of maintenance  Potal expended.  Milotted  Balance unexpended July Deductions on account of Net amount to be a	1932  1, 1935 revocation	of allotme	1934 \$2,802,605 2,819,258 2,917,380	.11 .47	3 3 1935 \$500, 531, 20 527, 455, 75 625, 000, 00	1936 \$99,017.78 115,440.60 195, 666, 61 80, 226, 01 115, 440, 60
Net total expenditures. Total amount appropriat  Fiscal year ending June 30  Cost of new work. Cost of maintenance  Potal expended.  Milotted  Balance unexpended July Deductions on account of Net amount to be a	1932  1, 1935  revocation ecounted for	of allotme	1934 \$2,802,605 2,819,258 2,917,380	.11 .47	3 3 1935 \$500, 531, 20 527, 455, 75 625, 000, 00	\$99,017.78 115,440.60 -80,226.01
Net total expenditures. Total amount appropriat  Fiscal year ending June 30  Cost of new work. Cost of maintenance  Potal expended.  Milotted  Balance unexpended July Deductions on account of Net amount to be a dross amount expended.  Less reimbursements colliness reimbursements colliness.	1932  1, 1935 revocation accounted for accou	of allotme	1934 \$2,802,605 2,819,258 2,917,380	36	\$500, 531, 20 \$500, 531, 20 \$27, 455, 75 625, 000, 00 \$584, 60 144, 00	\$99,017.75  115,440.60  115,440.60  115,440.60
Net total expenditures. Total amount appropriat  Fiscal year ending June 30  Cost of new work. Cost of maintenance.  Potal expended.  Milotted.  Net amount to be a stross amount expended.  Less reimbursements colleges reimbursements colleges of new work to June cost of maintenance cost of cost of cost of maintenance cost of cost of cost of maintenance cost of	1932  1, 1935  revocation ected  EMERGENC 30, 1936  ine 30, 1936	of allotme	1934 \$2,802,605 2,819,258 2,917,380	36	3 3 1935 \$500, 531, 20 527, 465, 76 625, 000, 00 \$ 584, 60 144, 00	\$99,017.78 1936 \$99,017.78 115,440.60 195, 686.61 80, 226.01 115,440.60 115,440.60
Net total expenditures. Total amount appropriat  Fiscal year ending June 30  Cost of new work. Cost of maintenance.  Potal expended.  Milotted.  Net amount to be a stross amount expended.  Less reimbursements colleges reimbursements colleges of new work to June cost of maintenance	1, 1935	of allotme	1934 \$2,802,605 2,819,258 2,917,380	\$6.51 .11 .47	3 1935 \$500, 531, 20 527, 455, 75 625, 000, 00 \$584, 60 144, 00	1936 \$99, 017, 78 115, 440, 60 \$99, 226, 01 115, 440, 60 115, 440, 60 115, 440, 60 116, 440, 60 364, 495, 21
Net total expenditures. Total amount appropriat  Fiscal year ending June 30  Cost of new work. Cost of maintenance  Potal expended  Allotted  Net amount to be a stross amount expended  Less reimbursements collicions of new work to June Cost of new work to June Cost of maintenance in June Cost of m	1932  1932  1, 1935  revocation ecounted for ected  30, 1936  ment work fune 30, 1936	of allotme  Of une 30, 1	1934 \$2,802,605 2,819,258, 2,917,380.	\$6	3 1935 \$560, 531, 20 527, 455, 75 625, 000, 00 \$584, 60 144, 00	1936 \$99, 017, 78 115, 440, 60 195, 666, 61 80, 226, 01 115, 440, 60 115, 440, 60 115, 440, 60 116, 440, 60 117, 440, 60 118, 440, 60 118, 440, 60
Net total expenditures. Total amount appropriat  Fiscal year ending June 30  Cost of new work. Cost of maintenance  Total expended  Allotted  Balance unexpended July Deductions on account of Net amount to be a Gross amount expended  Less reimbursements collected of new work to June Cost of new work to June Cost of maintenance to June Cost of maintenanc	1932  1932  1, 1935  revocation ecounted for ected  30, 1936  ment work tune 30, 1936  area  30, 1936	of allotme  Of une 30, 1	1034 \$2,802,605 2,819,258 2,917,380	36	\$500, 531, 20 \$500, 531, 20 \$27, 455, 75 625, 000, 00 \$584, 60 144, 00	1936 \$99, 017. 75 115, 440. 60 195, 666. 61 80, 226. 01 115, 440. 60 115, 440. 60 115, 440. 60 116, 440. 60 116, 440. 60 117, 440. 60 118, 440. 60 118, 440. 60

Fiscal year ending Ju		1032	1933	193	34	1935	1936
Cost of non most							\$664, 495, 2
Total expended		-					
Allotted							039, 220, 8
						φε, 000, 00	v
Balance unexpended Ju Gross amount expended	ly 1, 1935_		/ property and the last of the			\$1,	000, 000, 00 639, 226, 83
Balance unexpend Amount covered by unco	ded Inno 9	A 1000					360, 773. 17 360, 773. 17
CONSOLIDATED COST AND F	a ,iaionanp	UMMARY SSOURI RI	FOR MISS	sissip	PI RI	VER, OIII	O RIVER TO
Cost of new work to Ju Cost of maintenance to	ne 30, 1936_			•		Ø134 (	000 000 0=
Cost of maintenance to	June 30, 1	936				18,	455, 329, 95 559, 331, 84
Total cost of pern Minus accounts payable	nanont	L 1 Y		_		49.	792, 661, 79 20, 614, 25
Net total expendi Unexpended balance Jui	tunaa						
Total amount appr	ropriated to	June 30,	1936			52, 7	702, 332. 48
Piscal year ending June 30	1932	1033	19	34	1	935	1936
Cost of new work	\$1,008,610,87 1,120,165,37	\$2, 354, 007. 951, 859.	36 \$1,080,0	073, 68 016, 53		. 879. 18 . 974, 77	\$805, 110. 11 044, 152. 00
Total cost	2, 128, 776, 24	3, 305, 057, 6	5, 739, 6	300. 21		853. 05	1, 449, 262, 11
otal expended	2.701.931.92	3, 500, 802. (		543. 35	-1,43/	5,477.18	1, 123, 032, 56
llotted	260, 578, 67	5, 122, 901, 4				481. 38	2, 224, 714, 51
Balance unexpended July Amount allotted from priation Act approved , Amount allotted from priation Act approved	Apr. 9, 1935 War Depa May 15, 19	rtment A	oppro-	\$225, (	000.,0	00 00 — 2, 70	50, 000 <b>. 00</b>
Amount to be accorded account of	unted for revocation	of allotn	ients	~~~~.,		_ 4, 67	78, 602, 99 25, 285, 49
Net amount to be a mount expendedess;	iccounted f	or	\$1,				3, 317. 50
Reimbursements colle Receipts from sales		\$303, 58 145, 14	3. 73	448, 7	<b>35.</b> 13		
711			-			1, 12	3, 032, 56
Balance unexpended	I June 30, 1	1936				- 3, 03	0, 284. 94

·	
Outstanding liabilities June 30, 1936\$95, 345. 87 Amount covered by uncompleted contracts 1, 031, 965. 78	
D.1	· \$1, 127, 311. 65
Balance available June 30, 1936	1, 902, 973, 29
Amount (estimated) required to be appropriated for completion of existing project 1	
June 30 1938.	
For new work 1	4 400
For new work 1	1, 000, 000, 00 1, 000, 000, 00
Total 1	
1 Exclusive of available funds.	2, 000, 000, 00
the contract of the contract o	

2. MISSISSIPPI RIVER BETWEEN MOUTH OF MISSOURI RIVER AND CLARKSVILLE, MO.

See report, "Mississippi River between the Missouri River and Minneapolis, Minn.", page 878.

### 3. MISSOURI RIVER, HERMANN TO THE MOUTH

See report, "Missouri River, Kansas City to the mouth", page 982.

4. REMOVING SNAGS AND WRECKS FROM THE MISSISSIPPI RIVER BELOW THE MOUTH OF MISSOURI RIVER AND FROM OLD AND ATCHAFALAYA RIVERS

The section of the Mississippi River covered in this report was formerly in charge of the St. Louis engineer district, but for the purpose of administration on July 1, 1930, it was divided into three reaches, which are under the supervision and direction of the district engineers at St. Louis, Mo., Memphis, Tenn., and Vicksburg, Miss.

The St. Louis district extends from the mouth of the Missouri River to the mouth of the Ohio River, a distance of 195 miles. The Memphis district extends from the mouth of the Ohio River to the mouth of the Arkansas River, a distance of 398 miles. The Vicksburg district extends from the mouth of the Arkansas River to the Head of Passes, 671 miles, and includes 8 miles of Old River and 30 miles of the Atchafalaya River.

District engineers: St. Louis, Mo., Maj. Bartley M. Harloe, Corps of Engineers, to July 22, 1935; Lt. Col. P. S. Reinecke, Corps of Engineers, since that date; Memphis, Tenn., Lt. Col. Eugene Reybold, Corps of Engineers; Vicksburg, Miss., Lt. Col. Lunsford E. Oliver, Corps of Engineers.

Division engineers: For the river below the mouth of the Ohio, Brig. Gen. H. B. Ferguson, Corps of Engineers; for the river above the mouth of the Ohio, Col. Edmund L. Daley, Corps of Engineers, to August 19, 1935, and Col. J. N. Hodges, Corps of Engineers, since that data

Location.—The snagging district embraces that portion of the river between Head of Passes and the mouth of Missouri River, 1,265 miles, 8 miles of Old River (present mouth of Red River), and 30 miles of Atchafalaya River from Red River to Melville, La.; total, 1.995 miles.

The state of the s	IMPROVEMENTS	
<ol> <li>Mississippi River between the Ohio and Missouri Rivers</li> <li>Mississippi River between the Missouri River and Clarksville, Mo</li> <li>Removing snags and wrecks from the Mississippi River below the mouth of the Missouri River, and from Old and Atchafalaya Rivers</li> </ol>	900 4. Examinations, surveys, and contingencies (general) 9 5. Plant allotment 9 6. Upper Mississippi River Valley, flood control 9 7. Illinois and Des Plaines River Basin, flood control 9	12 12

## 1. MISSISSIPPI RIVER BETWEEN THE OHIO AND MISSOURI RIVERS

Location.—The Mississippi River rises in Lake Itasca, Minn., flows in a southerly direction 2,440 miles, and empties into the Gulf of Mexico. The portion included in this report embraces the 195-mile section known as the middle Mississippi, between the tributary Ohio and Missouri Rivers, 1,078 to 1,278 miles from the Gulf.

Previous projects.—The original project for the improvement of the Mississippi River between the Ohio and Missouri Rivers was recommended by a Board of Engineers in a report dated April 13, 1872, and concurred in by the Chief of Engineers. The cost and expenditures for the middle Mississippi prior to the adoption of the present project in 1881 were \$1,610,000 for new work.

(For further details see p. 1879 of the Annual Report for 1915.)

Existing project.—This provides for obtaining and maintaining a minimum channel depth of not less than 9 feet, a minimum width of not less than 300 feet at low water, with additional width in bends from the mouth of the Ohio River (1,078 miles from the Gulf) to the northern boundary of the city of St. Louis, 191 miles; thence 200 feet wide, with additional width in bends to the mouth of the Missouri River, 4 miles, all to be obtained by regulating works and

First, by regulating works, for closing sloughs and secondary channels, and narrowing the river; by building new banks where the natural width is excessive and protecting new and old banks from erosion where necessary to secure permanency.

Second, by dredging or other temporary expedients to maintain channels of project dimensions.

The project for regulating works was adopted in 1881 (Annual Report, 1881, p. 1536). Dredging was introduced as a part of the project by the River and Harbor Acts of June 3, 1896, June 13, 1902, March 2, 1907, and September 22, 1922, the latter of which provides for dredging channels to landing places on the main river and subsidiary sloughs for the river above the mouth of the Missouri River. That part of the project for the middle Mississippi which proposed regulating works was practically abrogated by acts of March 3, 1905, March 2, 1907, and the joint resolution of June 29, 1906. The River and Harbor Act of June 25, 1910, restored regulating works to the project and began appropriations with a view to the completion of the improvement between the Ohio and Misouri Rivers within 12 years, at an estimated cost of \$21,000,000, exclusive of amounts previously expended (H. Doc. No. 50, with accompanying atlas, 61st

Cong., 1st sess.; and H. Doc. No. 168, 58th Cong., 2d sess.). The River and Harbor Act of January 21, 1927, provided for a depth of 9 feet and width of 300 feet from the Ohio River to the northern boundary of St. Louis and increased the estimate for maintenance to \$900,000 annually (Rivers and Harbors Committee Doc. No. 9, 69th Cong., 2d sess.). The River and Harbor Act of July 3, 1930, modified the project between the northern boundary of the city of St. Louis and Grafton (mouth of Illinois River) to provide for a channel 9 feet deep and generally 200 feet wide with additional width around bends, at an estimated cost of \$1,500,000, with \$125,000 annually for maintenance (Rivers and Harbors Committee Doc. No. 12, 70th Cong., 1st sess.).

The estimated cost of new work, revised in 1934, is \$43,000,000,

with \$1,300,000 for annual maintenance.

Terminal facilities.—The water terminal and transfer facilities of the district are fully described as of December 31, 1918, in House Document No. 652, Sixty-sixth Congress, second session, pages 1211-1239. Additional data for terminal facilities is also contained in Transportation Series No. 2, 1929, Transportation in the Mississippi and Ohio Valleys.

was funder of the colory of Operations and results during fiscal year.—River stages were faverable to construction work, which was carried on extensively by hired labor with Government plant and by contract during the fall of 1936; river conditions were generally unfavorable during the spring of 1937 and work was carried on only intermittently. Regulating works were maintained and project dimensions of channel were secured by dredging. The district's standard specifications for construction work were used. Location, quantities, and costs of open river regulating works follow:

Class of work and locality	Miles	Dikes (hurdles)		
- and totality	of Ohio River	Number	Linear feet	Cost
New work by contract: Hurricane Field-Oairo Protection Powers Island-Goose Island Devils Island-Schenimann Willard-Hanging Dog Island. Wilkinson Seventy six-Crain Island Liberty Crain Island Chester Kaskaskia Island-Chester Kaskaskia Island-Ste. Genevieve Calico Island Calico Island Calico Island-Sulphur Springs	97 100 108 114 115	امًا	5,000 3,830 6,985 3,910 2,030 (1) 4,020 2,020 2,020 2,345 (1) 7,500 450	\$131, 899, 14 84, 016, 31 155, 464, 81 83, 440, 50 40, 702, 72 6, 872, 32 90, 931, 58
New work by United States plant and hired labor; Thebes Reach	43	67	38, 840 740	964, 551, 54 66, 655, 80
Total	170	3	960	21, 891, 06
faintenance by United States plant and hired labor			1,700	88, 546, 88 302, 215, 76

Reported fiscal year 1986.
Solid dike, brush and stone.

等的表现在是一个人的。 研究研究	Miles		Bank p	otection (r	evetments)	
Class of work and locality	above mouth of Ohio River	Number	Linear feet bank protec-	Squares ()	100 square et)	Costs
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			tion	Mattress	Paving :	Coats
New work by contract: Dogtonth Bend Cape Girardeau Devils Island Wilkinson Liberty Bend Kaskaskia Island Cornice Island Pulltight Sawyer Bend	23 50 60 92 100 115 150 158 187	(F) 1	(1) (1) 4,390 (1) (1) (1) 1,435 (1) 850	(i) (i) 4,382 (i) (i) (i) (i) 1,429 (i) 281	(1) 2, 229 (1) 67 (1) 828 670 404	\$55, 133, 05 124, 10 98, 883, 74 73, 14 10, 887, 74 7, 288, 51 44, 470, 5 25, 698, 61 17, 868, 26
		3	6, 675	6, 092	5, 052	260, 395. 17
Maintenance by United States plant and hired labor.				2,877	2, 652	155, 135, 17

Reported fiscal year 1936.

Regular funds.—The following new work was done with regular funds by hired labor with Government plant: Three dikes totaling 1,700 feet in length at a cost of \$88,546.86. Sixty-five dikes totaling 37,640 feet in length were built under contract at a cost of \$841,926.37. One revetment totaling 4,390 feet in length, consisting of 4,382 squares of mattress and 2,229 squares of paving, was built under contract at a cost of \$98,883.17. In addition to completed work there were under construction, by contract, 13 dikes to total 5,915 linear feet. The total cost of new work with regular funds was \$1,029,356.40.

The following maintenance work was conducted with regular funds. The required 9-foot channel was maintained, except for short periods needed to move a dredge to the shoal, by six United States dredges. During the year 68 shoals developed of which 51 were dredged once, 14 were dredged twice, 1 was dredged three times, 1 was dredged four times, and 1 was dredged five times. There were 8,921,980 cubic yards of sand and gravel removed by these dredges from channels through 68 bars, and 1,274,840 cubic yards of material removed in outside-the-channel dredging, 579,765 cubic yards of which was done for the Missouri Pacific Railroad at Little Rock Landing, Mo., for which the district was reimbursed. The channels dredged had a combined length of 41.8 miles, an average width of 280 feet and an average gain in depth of 3.9 feet. The total cost of dredging was \$563,403.40, all charged to maintenance.

Hydrographic surveys were made covering 293 miles of river, costing \$88,217.65. Other miscellaneous costs were: Snagging, \$16,176.73; aids to navigation, \$13,894.63; model tests, \$71,354.70; and mooring piles \$7,016.05, all charged to maintenance. The total cost of all maintenance was \$1,217,414.09.

Emergency Relief funds—New work.—The following work was done under contract: Two dikes totaling 1,200 feet in length were built at a cost of \$122,625.17; two revetments totaling 2,285 feet in length, consisting of 1,710 squares of mattress and 2,823 squares of paving, were built at a cost of \$161,512. In addition to completed

work there is under construction, by contract, one uncompleted reverment to total about 2,200 feet, to be paid for with Emergency Relief funds. The total cost, Emergency Relief funds, was \$284,-137.17, all new work.

The costs and expenditures during the fiscal year were as follows:

Kind of funds				
	New work	Maintenance	` Total	Expenditures
RegularEmergency Relief	\$1,029,356.40 284,137.17	\$1, 217, 414. 09	\$2, 246, 770, 49 284, 137, 17	\$2, 282, 503, 32 300, 566, 56
Total	1, 313, 493. 57	1, 217, 414. 09	2, 530, 907. 66	2, 589, 069, 87

Condition at end of fiscal year.—Open river regulating works are about 70 percent completed. The quantities required to complete the project are virtually the same as estimated in last annual report (120 dikes, 90,000 linear feet, and 50 revetments, 263,000 linear feet) inasmuch as practically all the work done during the fiscal year was in replacement of work damaged or destroyed by ice in the spring of 1936. Dikes and revetments are now in very good repair and the channel has been greatly improved by the work that has been done. Dredging is required at low stages to remove temporary shoals and maintain the required channel depths.

In recent years, notwithstanding the unusual low water that has prevailed, the project dimensions of channels have generally been maintained throughout the navigation season. The navigation season usually lasts from the middle of February to the middle of December, the river being generally closed by ice the remainder of the year. The river is generally above the 10-foot stage, St. Louis gage, for 6 months of the year, latter part of February to latter part of August, during which time project channel depths generally prevail without dredging.

The following table gives condition of the channel during the fiscal year 1937:

	Length of section	Affording less than 9 feet	Period	Afford- ing more then 9 feet	Period	Proposed low- water width	Control- ling depth 1
Mouth of Ohio to Commercial Point Commercial Point to Commerce Commerce to Grays Point Grays Point to Grand Tower Grand Tower to Fort Gage Fort Gage to Little Rock Little Rock to River Des Peres River Des Peres to northern	Miles 32. 0 7. 7 6. 5 33. 5 36. 3 9. 5 46. 5	Miles 1.2 .8 .6 6.1 2.6 3.0 5.8	Days 45 16 19 51 71 37 63	Miles 31.0 6.4 6.3 27.4 33.6 6.5 40.7	Days 230 259 256 224 204 238 212	Feet 2, 000 2, 500 2, 085 2, 250 2, 250 2, 250 2, 250 2, 250	Feet 7 6 6 5 6 5 6 5 5 5 5 5 5 5 5 5 5 5 5 5
boundary, city of St. Louis. Northern boundary to mouth	19.2	7.9	81	11, 1	194	1,700	514
of Missouri River.	3.8	1.7	64	2.4	213	2, 250	634

<sup>.</sup> Lowest stages known during navigation season, occured in fall 1936.

The costs and expenditures under the existing project to June 30, 1937, have been as follows:

Kind of funds	1. 1. 1. 1.	Costs		
	New work	Maintenance	Total	Expenditures
Regular Public Works Emergency Relief	\$26, 526, 036. 68 3, 462, 154. 46 948, 632. 38	\$19, 776, 745. 93	\$46, 302, 782, 61 3, 462, 184, 46 948, 632, 38	\$46, 193, 169, 57 3, 462, 154, 46 945, 793, 38
Total.	30, 936, 823, 52	19, 776, 745. 93	50, 713, 589. 45	50, 601, 117, 41

Proposed operations.—The unexpended balance at the end of the year, including accounts receivable, together with an allotment of \$1,975,000 made since June 30, 1937, will be applied as follows: REGULAR FUNDS
Accounts payable June 30, 1937

Accounts payable, June 30, 1937		φ100, 013.
New work:  By contract (completion of existing contract of June 30, 1938:  Piling dikes:  Hurricane Field-Cairo protection  Powers Island-Goose Island		
to Turk 200 took	cts): July 1, 1997	
wade 30, 1938;	2, 2001	•
Filing dikes:	and the same of the same	
Burricane Field-Cairo protection.	<b>\$2</b> 5, 500, 00	
Powers Island-Goose Island  Devils Island-Schenimann	10.600.00	
Devils Island-Schenimann Willard-Hanging Dog Lead	42, 700, 00	· • · · ·
Willard-Hanging Dog Island Crain Island Kaskaskia Island-Chester By contract, July 1, 1937, to June 30, 1938:	105, 200, 00	· I
Crain Island	43, 600, co	,
By contract Toland Island-Chester	~ 41, 300, 00	•
By contract, July 1, 1937, to June 30, 1938:	,,,,,,,,,,	
Time unes		
Grand Tower Island	300, 500, 00	\$ . S
Grand Tower Island Ste. Genevieve, Ill. and Mo Fish Bend-Danby Landing	90, 800, 00	
Fish Bend-Danby Landing Calico Island-Cornice Island	145, 000, 00	,
Calico Island-Cornice Island	135,000,00	
Groonfold To	==(5, 500, 00	
Greenfield Bend-Hurricane Field Wilkinson-Liberty Bend	45, 300, 00	
Wilkinson-Liberty Bend	60, 200, 00	
Ry hirad labor with we to a		1, 045, 700. 00
By hired labor with United States plant, Jul 30, 1938:	y 1, 1937, to June	
Piling dikes: Horsetail, east		
Tiorsetall, east		48, 000 oc
Total name monte		20,000.00
Total new work	No tree care and grey time you got any and any any any any any any any	1, 093, 700, 00
By hired labor with Tintes at	,	-,, 100, 00
By hired labor with United States plant, Jul. 30, 1938:	y 1, 1937, to June	
Dikes and reverments		,
Dikes and revetments	\$243, 170.00	
Aids to navigation Project channel dredging Snagging Surveys, tests, and studies	18, 000, 00	
Snagging	<b></b> 792, 500, 00	
Surveys, tests and studios	30, 000, 00	
	~~~~ 120, UUU, U()	
		. 208, 670, 00
Unallocated balance		-, -00, 0.0, 00
		25, 41
Total for all work		

The unexpende	ad halam		1	The second	of the second
receivable, will b	e applied	as follows	a or one le	er, moind	ing accoun
Accounts payable, New work: By con	June 30, 19	937	ing a transition of the state of		
New Work: By con	tract (com	pletion of e	xisting cont	racts) July	
Total Emerge	ncy Relief	funde		the second	· :
year 1939 as follo	DANS.	n be pron	tably expe	nded duri	ng the fisc
New work:	terr right	Marin Reim	· · · · · · · · · · · · · · · · · · ·	· . • .	
By contract, Jul Dikes Revetments By hired labor,	y 1, 1988, t	to June 30,	1939:		er tratt
Revetments				<b>\$450,</b> 00	00
By hired labor, . Dikes	July 1, 1938	, to June 30	), 1939:	400, 00	<i>.</i>
Revetments				75, 00	00
Dikes				75, QC	<b>X</b> 0
Maintenance:	***		* .		- <b>41, 000, 0</b> 0
A John Dami Ver	on United	States plan	it, July 1, 19	38.	
Dikes and re	Vetmonte				_
Project chan Surveys, test	nel dredgin	g		450, 00 700, 00	0
Surveys, testi	s, and studi	es		125.00	Ö.
Surveys, test				25, 00	Ò
Total for all -	1 to	*			1,300,00
Total for all w	ork				- 1, 800, 00
Total for all w	ork hat with	the men			2,300,00 2,300,00 he projec
Total for all w	orkhat, with complete.	the men	osed expen		2,300,00 2,300,00 he projec
Total for all w It is expected to will be 76 percent	hat, with complete.	the prop	osed expen	iditures, t	2,300,00 2,300,00 he projec
Total for all w It is expected to will be 76 percent	hat, with complete.	the prop	osed expen	iditures, t	2,300,00 2,300,00 he projec
Total for all w It is expected to will be 76 percent	hat, with complete.	the prop	osed expen	iditures, t	2,300,00 2,300,00 he projec
Total for all w  It is expected to will be 76 percent  Most of new work to J  Cost of maintenance to Total cost of new work to J	hat, with complete.  Cost and AINTENANC une 30, 193 o June 30,	the proposit financial E AND IMPRO	osed expensummary	nditures, t	- 1, 300, 00 2, 300, 00 he projec , 598, 191, 14
Total for all w  It is expected to the service of t	hat, with complete.  Cost and AINTENANC une 30, 193 o June 30, rmanent were June 30,	the proposit financial E AND IMPRO	osed expensummary	nditures, t	- 1, 300, 00 2, 300, 00 he projec , 598, 191, 14 , 776, 745, 93
Total for all w  It is expected to the service of t	hat, with complete.  Cost and AINTENANCE une 30, 193 o June 30, rmanent we e June 30, attures	the proposed financial E AND IMPRO 1937 Ork to June 1937	eummary  OVEMENT FUN  30, 1937	nditures, t	- 1, 300, 00 2, 300, 00 he projec , 598, 191, 14 , 776, 745, 93 , 374, 937, 07 109, 613, 94
Total for all w  It is expected to the service of t	hat, with complete.  Cost and AINTENANCE une 30, 193 o June 30, 19	the proposed financial E AND IMPRO 1937 Ork to June 1937	eummary OVEMENT FUN 30, 1937	oditures, t	7, 300, 00 2, 300, 00 he project , 598, 191, 14 , 776, 745, 93 , 374, 937, 07 109, 613, 94
Total for all w  It is expected to the service of t	hat, with complete.  Cost and AINTENANCE une 30, 193 o June 30, 19	the proposed financial E AND IMPRO 1937 Ork to June 1937	eummary OVEMENT FUN 30, 1937	oditures, t	- 1, 300, 00 2, 300, 00 he projec , 598, 191, 14 , 776, 745, 93 , 374, 937, 07 109, 613, 94
Total for all w  It is expected to the service of t	hat, with complete.  Cost and AINTENANCE une 30, 193 o June 30, 19	the proposed financial E AND IMPRO 1937 Ork to June 1937	eummary OVEMENT FUN 30, 1937	oditures, t	7, 300, 00 2, 300, 00 he project , 598, 191, 14 , 776, 745, 93 , 374, 937, 07 109, 613, 94
Total for all w  It is expected to will be 76 percent work to Joseph Total cost of percent will be 10 percen	hat, with complete.  Cost and AINTENANCE une 30, 193 o June 30, 193 o June 30, and	the proposed financial E AND IMPRO 1937 ork to June 1937 to June 30	osed expension of the summary over the s	1 satures, t	1, 300, 00 2, 300, 00 he project , 598, 191, 14 , 776, 745, 93 , 374, 937, 07 109, 613, 94 , 265, 324, 03 437, 008, 45 702, 332, 48
Total for all w  It is expected to will be 76 percent will be 76 perce	corkhat, with complete.  Cost and AINTENANC une 30, 193 o June 30, 193 o June 30, ditures une 30, 193 opropriated  1933  \$2,354,097.86  951,859.78 3,305,957.64	the proposed financial E AND IMPRO 1937 Ork to June 1937 to June 30 1934 \$1,277,468,17	osed expensummary ovement fun 30, 1937	1 stures, t	1, 300, 00 2, 300, 00 he project , 598, 191, 14 , 778, 745, 93 , 374, 937, 07 109, 613, 04 , 265, 324, 03 437, 008, 45 702, 332, 48
Total for all w  It is expected to will be 76 percent work to Joseph Total cost of percent will be a second	corkhat, with complete.  Cost and AINTENANC une 30, 193 o June 30, 193 o June 30, ditures une 30, 193 opropriated  1933  \$2,354,097.86  951,859.78 3,305,957.64	the proposed financial E AND IMPRO 1937 Ork to June 1937 to June 30 1934 \$1,277,468,17 1,659,616.53	osed expensummary ovement fun 30, 1937	1 stures, t	1, 300, 00 2, 300, 00 he project , 598, 191, 14 , 776, 745, 93 , 374, 937, 07 109, 613, 04 , 265, 324, 03 437, 008, 45 702, 332, 48

# 906 REPORT OF CHIEF OF ENGINEERS, U. S. ARMY, 1937

	, 1936				2, 669, 511. 7 2, 232, 503. 3
Balance unexpended June 3	0. 1937			•	
Balance unexpended June 3 Outstanding liabilities June Amount covered by uncomp	30, 1937 leted contr	acts	\$80, 40	08. 55	437, 008. 4
* •				<del></del>	378, 542. 39
Balance available Juramount allotted since June	00, 2001			. 1	58, 466, 06 , 975, 000, 00
Balance available for	fiscal year	1938			038 400.00
Amount (estimated) require tion of existing project 2	ed to be ar	propriate	ed for con	ıple-	
Amount that can be profited	lw			11	, 400, 000. 00
Amount that can be profitab June 30, 1939: For new work <sup>2</sup> For maintenance <sup>2</sup>					
For maintenance 2					000,000.00
Total 8			~	1,	300, 000. 00
Total **  Exclusive of available funds.	~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~			2,	300, 000. 00
EX	ERGENCY R	Citte vive			
Cost of new work to June 30, Cost of maintenance to June	1937 30, 1937			\$	948, 632, 38
Total cost of permanent	t month to 1	· · · · ·			
Minus accounts payable June	30, 1937	une so, 1	1937	(	948, 632, 38
Total cost of permanent Minus accounts payable June					948, 632, 38 2, 839, 00
Net total avnondit					2, 839. 00
Net total expenditures Unexpended balance June 30,	1937			{	2, 839. 00 945, 793, 38 54, 208, 89
Net total expenditure	1937			{	2, 839. 00 945, 793, 38 54, 208, 89
Net total expenditures Unexpended balance June 30,	1937ted to June			{	2, 839. 00 945, 793, 38 54, 208, 89
Net total expenditures Unexpended balance June 30, Total amount appropria  Fiscal year ending June 30	1937ted to June	934	1935	1936	2, 839. 00 945, 793. 38 54, 206. 62 900, 000. 00
Net total expenditures Unexpended balance June 30, Total amount appropria  Fiscal year ending June 30  Cost of new work	1937ted to June	980, 1987	1935	1936	2, 839. 00 945, 793. 38 54, 206. 62 900, 900. 00
Net total expenditures Unexpended balance June 30, Total amount appropriat  Fiscal year ending June 30  Cost of new work  Jost of maintenance.  Jost of expended.	1937ted to June	980, 1987	1935	1936	2, 839. 00 945, 793. 38 54, 206. 62 900, 900. 00
Net total expenditures Unexpended balance June 30, Total amount appropria:  Fiscal year ending June 30  Cost of new work Cost of maintenance.  Cotal expended.	1937ted to June	1934	1935	1936 \$664, 495, 21 639, 226, 83	2, 839. 00 945, 793. 38 54, 206. 62 1937 \$284, 187. 17 306, 566, 55
Net total expenditures Unexpended balance June 30, Total amount appropria  Fiscal year ending June 30  Cost of new work Cost of maintenance. Cotal expended.	1937ted to June	1934	\$1,000,000	1936 \$664, 495, 21 639, 226, 83	2, 839. 00 945, 793. 38 54, 206. 62 900, 900. 00 1937 \$284, 187. 17 306, 566, 55
Net total expenditures Unexpended balance June 30, Total amount appropria  Fiscal year ending June 30  Cost of new work Cost of maintenance Cotal expended	1937ted to June	1934	\$1,000,000	1936 \$664, 495, 21 639, 226, 83	2, 839. 00 945, 793. 38 54, 206. 62 900, 900. 00 1937 \$284, 187. 17 306, 566, 55
Net total expenditures Unexpended balance June 30, Total amount appropria  Fiscal year ending June 30  Cost of new work Cost of maintenance  Fotal expended  Balance unexpended Tyles 1, 100	1937ted to June	1934	\$1,000,000	1936 \$664, 495, 21 639, 226, 83	2, 839. 00 945, 793. 38 54, 206. 62 900, 000. 00  1937 \$284, 187. 17  306, 566, 55
Net total expenditures Unexpended balance June 30, Total amount appropria  Fiscal year ending June 30  Cost of new work Cost of maintenance Cotal expended  Balance unexpended July 1, 19  Fross amount expended  Balance unexpended July 1, 19	1937ted to June	1934	\$1,000,000	1936 \$664, 495, 21 639, 226, 83	2, 839. 00 945, 793. 38 54, 206. 62 900, 000. 00  1937 \$284, 187. 17 306, 566, 55
Net total expenditures Unexpended balance June 30, Total amount appropria  Fiscal year ending June 30  Cost of new work Cost of maintenance Cotal expended  Balance unexpended July 1, 19 Fross amount expended  Balance unexpended July 1, 19	1937ted to June	1934	\$1,000,000	1936 \$664, 495, 21 639, 226, 83	2, 839. 00  945, 793. 38  54, 206. 62  1937  \$284, 187. 17  306, 566. 55  60, 773. 17  6, 566. 55  4, 206. 62
Net total expenditures Unexpended balance June 30, Total amount appropria  Fiscal year ending June 30  Cost of new work Cost of maintenance Cotal expended  Balance unexpended July 1, 19  Fross amount expended  Balance unexpended June  Balance unexpended June  Cost of maintenance  Cotal expended  Balance unexpended July 1, 19  Fross amount covered by uncomplete  Consolidated Cost and Finance	1937ted to June  1933  36  30, 1937d contracts  AL SUMMA	1934 1934 RY FOR M	\$1,000,000	1936 \$664, 495, 21 639, 226, 83	2, 839. 00  945, 793. 38  54, 206. 62  1937  \$284, 187. 17  306, 566. 55  4, 206. 62  4, 206. 62  4, 206. 62
Net total expenditures Unexpended balance June 30, Total amount appropria  Fiscal year ending June 30  Cost of new work Cost of maintenance.  Cotal expended.  Balance unexpended July 1, 19  Fross amount expended June Balance unexpended June mount covered by uncomplete	1937ted to June 1933 36 36 30, 1937d contracts AL SUMMAR O MISSOURI	1934 1934 RY FOR M	\$1,000,000	1936 \$664, 495, 21 639, 226, 83 	2, 839. 00  245, 793. 38  54, 206. 62  000, 000. 00  1937  \$284, 187. 17  306, 566. 55  4, 206. 62  4, 206. 62  10 RIVER
Net total expenditures Unexpended balance June 30, Total amount appropria  Fiscal year ending June 30  Cost of new work Cost of maintenance.  Fotal expended.  Balance unexpended July 1, 19  Fross amount expended June Balance unexpended June mount covered by uncomplete	1937ted to June 1933 36 36 30, 1937d contracts AL SUMMAR O MISSOURI	1934 1934 RY FOR M	\$1,000,000	1936 \$664, 495, 21 639, 226, 83 	2, 839. 00  245, 793. 38  54, 206. 62  000, 000. 00  1937  \$284, 187. 17  306, 566. 55  4, 206. 62  4, 206. 62  10 RIVER
Net total expenditures Unexpended balance June 30, Total amount appropriate  Fiscal year ending June 30  Cost of new work Cost of maintenance Fotal expended  Balance unexpended July 1, 19 Fross amount expended  Balance unexpended June  Balance unexpended June  Cost of maintenance  Cost of new work  Cost of new work	1937ted to June  1933  36 30, 1937 d contracts  ML SUMMA  O MISSOURI  37 1937	1934 1934 RY FOR M	1935 \$1,000,000	1936  1936  \$664, 495, 21  639, 226, 83	2, 839. 00  245, 793. 38  54, 206. 62  000, 000. 00  1937  \$284, 187. 17  306, 566, 55  4, 206, 62  4, 206, 62  10 RIVER  3, 823. 52  3, 745, 93

Total cost 3, 305, 957, 64 5, 739, 690, 21 1, 493, 853, 95 1, 449, 262, 11  Total expended 3, 599, 802, 51 5, 725, 543, 35 -1, 435, 477, 18 1, 123, 032, 56  Allotted 5, 122, 904, 45 5, 180, 944, 70	1937 11, 313, 493, 57 11, 217, 414, 00 2, 580, 907, 66 2, 589, 060, 87
Fiscal year ending June 30 1933 1934 1935 1936  Cost of new work. \$2,354,097.86 \$4,080,073.68 \$593.879.18 \$805,110.11 \$050,075.00 \$1,659,616.53 \$99,974.77 644,152.00 \$1,659,616.53 \$99,974.77 644,152.00 \$1,659,616.53 \$1,659,616.53 \$1,449,262.11 \$1,123,032.66 \$1,659,944.70 \$1,435,477.18 \$1,123,032.66 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100.11 \$1,100	1937 11, 313, 493, 57 1, 217, 414, 00 2, 589, 060, 87
Cost of new work \$2,354,097.86 \$4,080,073.68 \$593,879.18 \$805,110.11 \$050,075.85 \$1,659,616.53 \$99,974.77 \$644,152.00 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.000 \$1.	11, 313, 493, 57 1, 217, 414, 00 2, 530, 907, 66 2, 539, 069, 87
Total cost. 3, 305, 957, 64 5, 739, 690, 21 1, 493, 853, 95 1, 449, 262, 11  Total expended. 3, 599, 802, 51 5, 725, 543, 35 -1, 435, 477, 18 1, 123, 032, 56 5, 122, 904, 46 5, 160, 944, 70 -664, 481, 38 2, 224; 714, 51  Balance unexpended July 1, 1936 \$3, 08 Gross amount expended	1, 217, 414, 00 2, 580, 907, 66 2, 589, 069, 87
Total cost 3, 305, 957. 64	2, 580, 907, 66 2, 589, 069, 87
Allotted	2, 589, 069. 87
Allotted	
Balance unexpended July 1, 1936\$3,08 Fross amount expended\$2,58	
Balance available June 30, 193758	3, 466, 06
Balance available June 30, 193758	2, 749. 01 3, 466. 06: 5, 000. 00
Balance available for fiscal year 1938 2, 033 mount (estimated) required to be appropriated for completion of existing project 11, 400	466, 06
mount that can be profitably expended in fiscal year ending	, 000, 00
For new work <sup>1</sup> 1,000, For maintenance <sup>1</sup> 1,000, 1,300,	, 000, 00
Total <sup>1</sup> 2, 300,	
<sup>1</sup> Exclusive of available funds.	, 000. 00

See report, "Mississippi River between the Missouri River and Minneapolis, Minn.", page 916.

3. REMOVING SNAGS AND WRECKS FROM THE MISSISSIPPI RIVER BELOW THE MOUTH OF MISSOURI RIVER AND FROM OLD AND ATCHAFALAYA RIVERS

The section of the Mississippi River covered in this report was formerly in charge of the St. Louis engineer district, but for the purpose of administration on July 1, 1930, it was divided into three reaches, which are under the supervision and direction of the district engineers at St. Louis, Mo., Memphis, Tenn., and Vicksburg, Miss.

# I. MISSISSIPPI RIVER BETWEEN THE OHIO AND MISSOURI RIVERS

Location .- The Mississippi River rises above Lake Itasca, Minn, flows in a southerly direction 2.440 miles, and empties into the Gulf of Mexico. The portion included in this report embraces the 195mile section known as the middle Mississippi, between the tributary Ohio and Missouri Rivers, 1,078 to 1,273 miles from the Gulf.

Previous projects. The original project for the improvement of the Mississippi River between the Ohio and Missouri Rivers was recommended by a Board of Engineers in a report dated April 13, 1872, and concurred in by the Chief of Engineers. The cost and expenditures for the middle Mississippi prior to the adoption of the present project in 1881 were \$1,610,000 for new work.

(For further details see p. 1879 of the Annual Report for 1915.)

Existing project.—This provides for obtaining and maintaining a minimum channel depth of not less than 9 feet, a minimum width of not less than 300 feet at low water, with additional width in bends from the month of the Ohio River (1,078 miles from the Gulf) to the northern boundary of the city of St. Louis, 191 miles; thence 200 feet wide, with additional width in bends to the mouth of the Missouri River, 4 miles, all to be obtained by regulating works and dredging: First, by regulating works, for closing sloughs and secondary channels, and narrowing the river; by building new banks where the natural width is excessive and protecting new and old banks from erosion where necessary to secure permanency. Second, by dredging or other temporary expedients to maintain channels of project dimensions,

The estimated cost of new work, revised in 1934, is \$43,000,000,

with \$1,300,000 for annual maintenance.

The existing project was authorized by the following river and harbor acts:

Aet	Work authorized	Documents and reports
Sept. 22, 1922 Mar. 3, 1995 (Mor. 2, 1937) June. 26, 1940 June. 21, 1927 oly. 3, 1930	Dredging autroduced as more of the analysis	1 1110

Terminal facilities.—The water terminal and transfer facilities of the district are fully described as of December 31, 1918, in House Document No. 652, Sixty-sixth Congress, second session, pages 1211-1239. Additional data for terminal facilities are also contained in Transportation Series No. 2, 1929, Transportation in the Mississippi

and Ohio Valleys,

Operations and results during fiscal year.—River stages were favorable to construction work, which was carried on extensively by contract and by hired labor with Government plant during the fall of 1937; river conditions were generally unfavorable during the spring of 1938 and work was carried on only intermittently. Regulating works were maintained and project dimensions of channel were secured by dredging. The district's standard specifications for construction work were used. Location, quantities, and costs of open river regulating works follow:

Class of work and locality	Miles	Dikes (hardles)		
	af Ohio River	Number	Linear feet	Cost
New work by contract:  Hutricane Field-Cairo Protection Powers Island-those Island Devils Island-Stenein ann Wilhard-Hanging Dog Island Grand Tower Island Crain Island Kaskaskin Island-Chester. Ste. Genevieve, Ill. and Mo. Fish Bend Fish Bend-Damby Landing Calico Island-Cornice Island	37 59 65 79 105 113	2 1 12 2 4 4 9 (1) 7	1, 395 425 500 3, 540 980 2, 490 2, 395 2, 615 2, 575 (1) 4, 280	7, 129, 00 41, 489, 53 79, 513, 81
New work by United States plant and hired labor: Establishment Island. Horsetail East.	132	(1)	21, 215	515, 776, 57 
Total.	160	4	1, 225	39, 524, 53
aintenance by United States plant and hired labor		4	1, 225	51, 614. 28
- Totale and integ inpor			4, 615	69, 773, 72

	Miles		} <del>-</del>	lank grotec	tion (revet	ments)		
Class of work and locality	nbove mouth of Ohlo River	Num- ber	Linear feet bank protec-	Squares (	100 square	Toe piles,	1	
			50.	tion	Mattress	Paying	bank pro- tected	Costs
New work by contract:  Greenfield Bend-Harricane Field	7 78 - 85-100	1 1 2 2	1, 300 8, 730 2, 275 12, 305	1, 650 11, 068 2, 275 14, 993	704 5, 256 1, 178 7, 168 4, 045	20, 980	\$37, 814, 04 216, 665, 49 43, 764, 61 298, 244, 14 200, 380, 88	

<sup>1</sup> Dikes not completed during fiscal year 1938.

Regular funds-New work.-Four dikes totaling 1,225 feet in length were built by hired labor with Government plant at a cost of \$51,644.28. Forty-eight dikes totaling 21,245 feet in length were built under contract at a cost of \$515,776.57. Four revetments totaling 12,305 feet in length, consisting of 14,993 squares of mattress and

7.168 squares of paving, were built under contract at a cost of \$298,-244.14. In addition to completed work there were under construction, by contract, 10 dikes to total 10,070 linear feet, and one revetment, length included in above table. The total cost of new work with regular funds was \$865,664.99.

Maintenance.—Dikes and revetments were repaired at a cost of \$270,160,60. The required 9-foot channel was maintained, except for short periods needed to move a dredge to the shoal, by five United States dredges. During the year 54 shoals developed of which 40 were dredged once, 7 were dredged twice, 6 were dredged three times, and 1 was dredged four times. There were 10,597,490 cubic yards of sand and gravel removed by these dredges from channels through 54 bars, 81,357 cubic yards of material removed in outside-the-channel dredging, and 74,629 cubic yards of material was removed in miscellaneous snagging operations. The channels dredged had a combined length of 31.8 miles, an average width of 297 feet, and an average gain in depth of 4 feet. The total cost of dredging was \$772,394.68, all charged to maintenance.

Hydrographic surveys were made covering 246 miles of river, costing \$96,067,05. Model studies were made at Waterways Experiment Station, Vicksburg, Miss., of the following river reaches: Boston Bar, Dogtooth Bend, Swiftsure, Grand Tower, and Chain of Rocks, at a total cost of \$59,139.61. Other miscellaneous costs were: Snagging, \$26,454.82; aids to navigation, \$2,071.98; and gages, \$1,132.01, all charged to maintenance. The total cost of all maintenance was \$1,227,420.75.

Emergency Relief funds\_New work.—There remains under contract one uncompleted revetment to total about 2,200 feet, to be paid for with Emergency Relief funds, on which no work was done pending the rectification of bank alinement by river currents. were no costs or expenditures from Emergency Relief funds.

The costs and expenditures during the fiscal year were as follows:

Kind of funds				
	New work	Maintenance	Total	Expenditures
Regular Emergency Relief	\$365, 664, 99	\$1, 227, 420, 75	\$2, 093, 085, 74	\$2, 138, 338, <b>2</b> 6
Total	865, 604, 99	1, 227, 420, 75	2, 093, 085, 74	2, 138, 338-29

Condition at end of fiscal year.—Open river regulation works are about 74 percent completed. The quantities required to complete the project are estimated as 73 dikes, 73,000 linear feet, and 50 revetments, 268,800 linear feet. Dikes and revetments are now in very good repair and the channel has been greatly improved by the work that has been done. Dredging is required at low stages to remove temporary shoals and maintain the required channel depths.

In recent years, notwithstanding the unusual low water that has prevailed, the project dimensions of channels have generally been maintained throughout the navigation season. The navigation season usually lasts from the middle of February to the middle of December, the river being generally closed by ice the remainder of

the year. The river is generally above the 10-foot stage, St. Louis gage, for 6 months of the year, latter part of February to latter part of August, during which time project channel depths generally prevail without dredging.

The following table gives condition of the channel during the fiscal

			Channel affording—								
Section Longth of section	of sec-	if sec. 9 feet or more		9 feet or less 7 f		7 feet	7 feet or less		6 feet or less		
	Length	Perlod	Longth	Period	Length	Period	Longth	Period	denth		
Oblo Itiver to Commer- cial Point	Miles	Milea	Days	Miles	Days	Miles	Days	Miles	Days		
ommercial Point to	32.7	32, 3	226	0.4	49	0.4	6	0	0	7	
Commerce to Grays	8.7	6.5	215	1, 2	60	0.4	4	0 1	اه	7	
Point.	6.6	5.8	250	0.8	19	0.4	5	0.4	5	6	
Tower to Fort	33. 7	31, 2	184	2, 5	91	2.4	32	0.4	12	6	
ort Clage th Little	36. 3	33. 5	156	2,8	119	2.8	31	0.4	4	8	
ittle Rock to River	9. 5	8, 3	228	1. 2	47	1, 2	19	0.4	8	_	
ver des Peres to Mer-	40.5	41.2	136	5.3	139	4.3	65	0.8	8	6	
coants Bridge	11, 2	10.8	255	0.4	20	0	0	0.8	- 1	8	
orthern boundary, city of St. Louis	8.0	7. 2	205	0.8	70	0.8	10	0	0	9	
nouth of Missouri	3.8	3. 4	227	0.4	1 48	0.4	10			6. š	

<sup>1</sup> Project width is 300 feet from Ohio River to northern boundary of St. Louis, and 200 feet from that point to Missouri River, with additional width in bends throughout.

2 Stage, St. Louis gage, was continuously below zero, for 87 days in fall of 1936, the previous record, and for 141 days in fall of 1937.

3 This is known as the "Chain of Rocks Reach."

The costs and expenditures under the existing project to June 30, 1938, have been as follows:

Kind of funds					
	New work Maintenance		Total	Expenditures	
Regular Public Works Emergency Relief.	\$27, 391, 701, 67 3, 462, 154, 46 948, 632, 38	\$21,004,166.68	\$48, 395, 868, 35 3, 462, 154, 46 948, 632, 38	\$48, 331, 507, 86 3, 462, 154, 46 945, 793, 38	
. 06///	31, 802, 488. 51	21, 004, 166. 68	52, 806, 655, 19	52, 739, 455. 70	

## 1018 REPORT OF CHIEF OF ENGINEERS, U. S. ARMY, 1938

Proposed operations. The unexpended balance, together with an allotment of \$300,000 received since June 30, 1938, will be applied as follows:

#### REQUIAR FUNDS

Accounts payable, June 30, 1938	State a state of the
New Work:	\$64, 360, 49
By contract (completion of existing contracts), July 1, 1938 to June 30, 1939:	
Pilling dikes:	
Ste. Genevieve, III. and Mo	0.00
Fish Bend Danby Landing 97, 40	U, VA) N-79A
Fish Bend Danby Landing 97, 40 Calleo Island Cornigo Island 91, 40	11, CC
Calleo Island Cornice Island 10,840 Bank protection: Wilkings, Lib. 10,840	3.00
Bank protection: Wilkinson-Liberty Bend 7, 466 By contract July 1 1928 to June 20	). 00
By contract, July 1, 1938, to June 30, 1939; Piling dikes:	
Price Landing	
Devils Island-Schoolmann William - W. 100	
Fish Bend. Called Island-Sulphon Scale 52, 200	. (W)
Calico Island-Sulphur Springs 52, 200 Bank protection Pring Landing D. 92, 800	(K)
Bank protection: Price Landing-Powers	. 1,71
Island Goose Island	00
Ry Mand Johnson Col. 20	1, 011, 480, 00
By bired labor with United States plant, July 1, 1938, to June 30, 1939;	11 1911 1 4 150(1), 1919
Piling dikes: Fort Chartres. 46, 400.	OÖ.
Crib dikes: Thebes Reach	(X)
Solid dikes: Grayshoro	00
Boston Bar	
	00
Price Landing 14,000, (	nó.
Powers Island 30, 000, (	10
en e	249, 300, ao
Total new work	1 900 500 00
Maintenance;	- 1, 200, 180, 00
By hired labor with United States plant, July 1, 1938 to June 30, 1939;	
Dikes and bank protoction	Λ
750 000 0	3
Surgery fosts and studies 30, 000, 00	)
80, 000, 00	)
Unallocated balance	- 1, 015, 000, 00
	3, 529, 67
Total regular funds	2 343 670 10
EMERGENCY RELIEF FUNDS	2,0,10,10,10
Unavanded between the second of the second o	
Unexpended balance at the end of the year will be applied as follows:	
Accounts payable, June 30, 1938  New work: By contract (geometric)	9 000 00
	2, 839, 00
Girardean Garage So, 1939; Bank protection, Cape	51, 367, 62
Total Emergency Relief funds	
Total Emergency Relief funds.	54, 206, 62
Total for all work	2 207 070 70
	4, 007, 870, 78

The sum of \$2,300,000 can be profitably expended during the fiscal

New work:					ing the fiscr
73					
By contract, July Dikes					
Dikesi Bank protec By hired labor, J	tion				\$300, 00 500, 00
Dikes	. ,	111 11111111111111111111111111111111111	4 10.40		
Bank protee	lion				100, 00 100, (k)
Total new	work		·		1 (100 00
Total new Maintenance (by hir 1939, to June 30, 19	ed labor y 40a -	vith United	l States p	lant, July	1, (100), 000
Dikes and bank	Time to all land				
Surveys, tests, an	id studios				770, (KX
Singging					100, 0 <b>0</b> 0 30, 000
Total maintenar	1100			· · · · · · · · · · · · · · · · · · ·	00, 144
Total for all w	ork				1,300,000
It is expected the will be 80 percent co	lat, with	the propo	sed expe	nditures,	2,300,000 The project
	-	l financial s	ատաուր		
мл	INTENANCE	AND IMPRO	VEMIENT 1812	N'ns	
Cost of new work to h	ma 20 4000	,			
Cost of maintenance to	June 30, 19	38		\$60 21	2, 463, 856, 13 1, 004, 166, 69
Total cost of peri Minus accounts payable					
					/14 DOA: (0)
Not total assumption	11900				04, 360, 49
Not total assumption	11900				04, 360, 49
Net total expendit Unexpended balance Ju Total amount app	tures ne 30, 1939	3		53 2	64, 360, 49 , 403, 662, 32 , 043, 670, 16
Net total expendit Unexpended balance Ju	tures ne 30, 1939	3		53 2	64, 360, 49 , 403, 662, 32 , 043, 670, 16
Net folal expendit Unexpended balance Ju Total amount app Fiscal year ending June 30	turesne 30, 1938 propriated to	30 June 30,	1938	53 2 55,	64, 360, 49 , 403, 662, 32 , 043, 670, 16 447, 332, 48
Net folal expendit Unexpended balance Ju Total amount app Fiscal year ending June 30 Cost of now work. Cost of maintenance	1934 \$1, 277, 468, 17 1, 059, 010, 53	3 June 30,  1935  \$33, 317, 03  899, 974, 77	1938	53, 2 55, 55, 1937 \$1,029,359,40 1,217,414,09	64, 360, 49 , 403, 662, 32 , 043, 670, 16 447, 332, 48
Net folal expendit Unexpended balance Ju Total amount app  Fiscal year ending June 30  Cost of now work. Cost of maintenance Total cost	1934 51, 277, 468, 17 1, 654, 616, 53 2, 937, 081, 70	3 June 30,  1935  \$33.317.93  839.974.77  933.322.75	1938	53 2 55, 1937 \$1,029,356,40	64, 360, 49 , 403, 662, 32 , 043, 670, 16 447, 332, 48
Net folal expendit Unexpended balance Ju Total amount app Fiscal year ending June 30  Cost of new work. Cost of maintenance. Total cost.	1934 \$1, 277, 468_17 1, 052, 016, 53 2, 937, 081, 70 2, 908, 285, 24	5 June 30,  1935  \$33, 317, 98  \$99, 974, 77  933, 322, 75  -1,962,932, 93	1938	55, 2 55, 1037 \$1,029,356,40 1,217,414,09 2,216,770,49 2,232,503,32	04, 360, 49 , 403, 662, 32 , 043, 670, 16 447, 332, 48 1938 \$405, 664, 99 1, 227, 420, 75 2, 093, 035, 74
Net folal expendit Unexpended balance Ju Total amount app Fiscal year ending June 30 Cost of now work. Cost of maintenance Total cost. Fotal expended Allotted	1934 \$1, 277, 468, 17 1, 059, 616, 53 2, 937, 084, 70 2, 900, 285, 24 2, 243, 564, 23	3 June 30,  1935  \$33, 317, 98  899, 974, 77  933, 322, 76  -1,962,932, 93  -2,259,481,38	1938 \$11, 507, 15 614, 152, 00 685, 749, 15 368, 365, 13 2, 304, 940, 52	55, 55, 1937 \$1, 029, 356, 40 1, 217, 414, 09 2, 246, 770, 49 2, 232, 503, 32	04, 360, 49 , 403, 662, 32 , 043, 670, 16 447, 332, 48 1938 \$405, 664, 99 1, 227, 420, 75 2, 093, 035, 74
Total amount app  Total amount app  Fiscal year ending June 30  Cost of now work. Cost of maintenance  Total cost  Fotal expended  Allotted  Balance unexpended July Amount allotted from Wation Act approved Apr. Amount allotted from Wation Act approved approved July Amount allotted from Wation Act approved July Amount to be accompanied.	1934 \$1, 277, 468, 17 1, 055, 616, 53 2, 937, 084, 70 2, 900, 285, 21 2, 243, 564, 23 1, 1937	3.3 June 30,  1935  \$33.317.08  \$39,974.77  933.322.75  -1,972,932.03  -2,259,481.38  ment Apprent Civil A  37  ent Civil A	1938	55, 1937 \$1,029,356,40 1,217,414,09 2,216,770,49 2,232,503,32	04, 360. 49 , 403, 662. 32 , 043, 670. 16 447, 332. 48  1938  \$\$\\$\\$\\$\\$\\$\\$\\$\\$\\$\\$\\$\\$\\$\\$\\$\\$\\$\\$\
Total amount app  Total amount app  Fiscal year ending June 30  Cost of new work Cost of maintenance  Total cost  Fotal expended  Allotted  Balance unexpended July Amount allotted from Watton Act approved Apr  Amount allotted from Watton Act approved appriation Act approved amount allotted from Watton Act approved Act a	1934  \$1, 277, 468, 17  1, 652, 616, 53  2, 937, 084, 70  2, 908, 285, 24  2, 243, 564, 23  1, 1937	3 June 30,  1935  \$33,317.98  \$39,974.77  933,322.75  -1,062,932.93  -2,259,481,38  ment Apprent Civil A  37  ent Civil A	1938	55,  1037  \$1,029,356,40 1,217,414,09 2,232,503,32  2,232,503,32  5,000 5,000 7,000 3,77 4,18 2,13	64, 360. 49 , 403, 662, 32 , 043, 670. 16 447, 332, 48  1938  \$\$\\$\\$\\$\\$\\$\\$\\$\\$\\$\\$\\$\\$\\$\\$\\$\\$\\$\\$\

1020 REPORT O	F CHIEF	OF ENGIN	EERS, U.	S. ARMY	, 1938
Outstanding liabilities Amount covered by u	s June 20 1	096	\$ 21	14, 390, 31 81, 741, 63	,
					\$326, 131, 94
Balance availal Amount allotted from approved June 11, 1	de June 30, - War-Depa 938	1938 rtment Civi	l Appropri	tion Act	1, 717, 538, 22 300, 000, 00
Balance availab	le for fised	l <sup>5</sup> vore 1020			(A) (A)
Amount (estimated) r of existing project '.	arrest bank to a	l		=	
Amount that can be p June 30, 1940; For new work 1	profitably e	xpended in	fiscal year	ending =	1, 000, 000, 00
For maintenance					1, 300, 000, 00
Total 1 1 Exclusive of available (	unds,				2, 300, (00), 00
	EMERGI	ency mader	FUNDS		
Cost of new work to Ji Cost of maintenance to	na 9a man			**	\$948, 632, 38
Total cost of peri Minus accounts payable	nanent wor June 30, 1:	k to June 30 938	0. 1938		948, 632, 38 2, 839, 00
Net total expend Unexpended balance Jus Total amount app	te on Thom.				945, 793, 38 54, 206, 62
			( <i>U</i> ()))=======	j	t, 000, 000, 00
Fiscal year ending June 30	1934	1935	1930	1937	1938
Cost of new work Cost of maintenance					
Potal expended			639, 226, 83	300, 566, 55	
llotted		\$1,000,000			
Balance unexpended July Balance unexpended June amount covered by uncon ONBOLIDATED COST AND F	npleted com	tracts			\$54, 206, 62 54, 206, 62 54, 206, 62
Cost of new work to Jun Cost of maintenance to Ju	000 1000		and the St. Inc you are had not you are a	\$33, 21,	412, 488, 51 004, 166, 68
Total cost of perma linus accounts payable J	mark mark				416, 655, 19 67, 199, 49
Net total expenditur nexpended balance June				Part	
Total amount appro	printed to	Tuno 20 10			

Fiscal year ending June 30	1934	1035	1936	] ,	937	1948
Cost of new work	4,659,616,53	\$503, 879, 18 899, 971, 77	\$805, 110, 11 014, 152 00	\$1,313 1,217	, 494, 57 , 414, 00	\$305, 664, 66 1, 227, 420, 7,
Total cost.	5, 739, 690, 21	1, 494, 853, 95	1, 410, 262, 11	· · · · · · ·	907.66	
Total expended	5, 725, 513, 35	-1,135,177.18	1, 123, 032, 56		069.87	2, 093, 085. 7
Allotted.	5, 160, 911, 70	-661, 481. 38	2, 224, 714. 51			2, 139, 338, 20 3, 715, 000, 00
Balance unexpended July Amount allotted from Wa ation Act approved Apr Amount allotted from Wa propriation Act approve Amount allotted from Wa propriation Act approve  Amount to be account Gross amount expended Balance unexpended Outstanding liabilities Jun Amount covered by uncom	5. 5. 1935 r Departm ed July 19 r Departm d June 11, infed for	ent Appropent Civil A, 1937, ent Civil A 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1938, 1	*120, *120, *0; *1, 975, 0; *1, 650, 0;	000. 00	3, 7 4, 2: 2, 1:	45, 000, 00 36, 215, 07 38, 338, 29 07, 876, 78
Rulanco anatistis r		_	<u></u>		.38	0, 338. 56
Bulance available Ju mount aliotted from War approved June 11 1022	me 30, 193; Depurtmer	s. it Civil Apr	propriation	Act	1, 71	7, 538, 22
24, 10,000					300	0, 000. 00
Balance available for mount (estimated) require of existing project.	fiscal year ed to be ap	r 1939 propriated	for complet	lon	2, 01	7, 538, 22
of existing project 1	bly expend	led in fisen	l year end	Ing	9, 900	000.00
June 30, 1940:						
*********				~~~	1, 000 1, 300	, 000, 00 , <b>000, 00</b>

2. MISSISSIPPI RIVER BETWEEN MOUTH OF MISSOURI RIVER AND CLARKSVILLE, MO.

See report, "Mississippi River between the Missouri River and Minneapolis, Minn.," page 1046.

3. REMOVING SNAGS AND WRECKS FROM THE MISSISSIPPI RIVER BELOW THE MOUTH OF MISSOURI RIVER AND FROM OLD AND ATCHAFALAYA RIVERS

The section of the Mississippi River covered in this report was formerly in charge of the St. Louis engineer district, but for the purpose of administration, on July 1, 1930, it was divided into three reaches, which are under the supervision and direction of the district engineers at St. Louis. Mo., Memphis, Tenn., and Vicksburg, Miss.

engineers at St. Louis, Mo., Memphis, Tenn., and Vicksburg, Miss.

The St. Louis district extends from the mouth of the Missouri
River to the mouth of the Ohio River, a distance of 195 miles. The
Memphis district extends from the mouth of the Ohio River to the
mouth of the Arkansas River, a distance of 399 miles. The Vicks-

#### IMPROVEMENT OF RIVERS AND HARBORS IN THE ST. LOUIS, MO., DISTRICT

This district includes the Mississippi River between the Ohio River and Clarksville, Mo., and for compliance with provisions of the Flood Control Act of June 22, 1986, includes the Mississippi River between Cape Girardeau, Mo., and Clarksville, Mo., on the right bank, and between Thebes, Ill., and Hamburg Bay, Ill., on the left bank. That section of Mississippi River between Missouri River and Clarksville is included in the report of Mississippi River between Missouri River and Minneapolis, Minn.
District engineer: Lt. Col. P. S. Reinecke, Corps of Engineers.

Division engineer: Lt. Col. Malcolm Elliott, Corps of Engineers, to May 1, 1939; Lt. Col. Philip B. Fleming, Corps of Engineers, acting division engineer, May 1 to June 8, 1989; Lt. Col. Malcolm Elliott,

Corps of Engineers, since that date.

IMP	ROVEMENTS	
1. Mississippi River between the Ohio and Missouri	11. Perry County drainage and	Þ
	18 and 3, Missouri 12. Kaskaskia Island drainege	
-Clarksville, Mo. 11	46 18. Ste. Genevieve levee district	:
3. Removing snags and wrecks from the Mississippi River below the mouth of the	No. 1, Missouri 1185  14. Fort Chartres and Ivy Landing drainage district No. 5,	
Missouri River, and from the Old and Atchafalaya Rivers	15. Harrisonville and Ivy Land 1136	
4. Examinations, surveys, and contingencies (general) 112 5. Plant allotment 112	trict No. 2, Illinois 1186	
Flood-control projects	17. Wilson and Wenkel and Prairie du Pont draine	
6. East Cape Girardeau and Clear Creek drainage dis-	and leves districts, Illinois. 1189 18. East St. Louis and vicinity, Illinois.	
7. North Alexander design	Dill. Neshorn dasings	
and levee district, Illinois 112 8. Clear Creek drainage and	6 20. Upper Mississippi Bivan	
) levee district, Illinois 112:	7 21. Preliminary examinations	
levee district, Illinois 1120 10. DeGognia and Fountain Bluff levee and drainage district, Illinois	22. Other flood-control projects	
district, Illinois 1180	submitted 1145	

# 1. MISSISSIPPI RIVER BETWEEN THE OHIO AND MISSOURI RIVERS

Location.—The Mississippi River rises above Lake Itasca, Minn, and, from that lake, flows in a southerly direction about 2,440 miles, and empties into the Gulf of Mexico. The portion included in this report embraces the 195-mile section known as the middle Mississippi, between the tributary Ohio and Missouri Rivers, about 1,078 to 1,278 miles from the Gulf. on as total in the Survey of the same

Previous projects.—The original project for the improvement of the Mississippi River between the Ohio and Missouri Rivers was recommended by a Board of Engineers in a report, dated April 13, 1872, and concurred in by the Chief of Engineers. For further details see page 1879 of the Annual Report for 1915 and page 1014 of,

the Annual Report for 1938.

Existing project.—This provides for obtaining and maintaining a minimum channel depth of not less than 9 feet, a minimum width of not less than 300 feet at low water, with additional width in bends from the mouth of the Ohio River (about 1,078 miles from the Gulf) to the northern boundary of the city of St. Louis, 191 miles; thence 200 feet wide, with additional width in bends to the mouth of the Missouri River, 4 miles; all to be obtained by regulating works and dredging: First, by regulating works, for closing sloughs and secondary channels, and narrowing the river; by building new banks where the natural width is excessive and protecting new and old banks from erosion where necessary to secure permanency. Second, by dredging or other temporary expedients to maintain channels of project dimensions.

The estimated cost of new work, revised in 1934, is \$43,000,000,

with \$1,300,000 for annual maintenance.

The existing project was authorized by the following river and harbor acts:

Acts	Work authorized	Documents
June 3, 1896		
June 13, 1902 Mar. 2, 1907	The project was fast of the broject	
Mar. 3, 1905   Mar. 2, 1907	These acts practically abrogated that part of the project for the middle Mississippi which proposed regulating works.	
June 25, 1910	Reg slating works restored to the project and appropriations begun with a view to the completion of the improvement between the Ohio and Missouri Rivers within 12 years at an estimated cost of \$21,000,000, exclusive of amounts previously expended.	H. Doc. No. 80, fist Cong., 1st sess. and H. Doc. No. 168, 58th Cong. 2d sess.
ian, 21, 1927	For a depth of 9 feet and width of 300 feet from the Ohio River to the northern boundary of the city of St. Louis, with the estimated cost of maintenance increased to \$900,000 annuals.	Rivers and Harbors Committee Doc. No. 9, 69th Cong., 2d sess.
nly 3, 19 <b>30</b>	Project between the northern boundary of the city of St. Louis and Grafton (mouth of Illinois River) modified to provide for a channel 9 feet deep and generally 200 feet wide with additional width around bends, at an estimated cost of \$1,500,000, with \$125,000 annually for maintenance.	Rivers and Harbors Committee Doc. No. 12, 70th Cong., 1st sess.

<sup>1</sup> Also joint resolution, June 29, 1908.

Recommended modifications of project.-Under date of March 15, 1939, the Chief of Engineers recommended modifications of the existing project to approve a comprehensive plan for development of the Mississippi River at Chain of Rocks so as to provide for construction of a lateral canal at an estimated first cost to the United States of

approximately \$10,290,000, with annual maintenance and operation costs of \$70,000, subject to such modification as the Chief of Engineers may find necessary when the project is undertaken; and to authorize the relocation of the river channel and reclamation of the area in Sawyer Bend for airport, park, recreational, and similar purposes at a cost to local interests of approximately \$17,555,000; provided that any modification of the present river channel required by the civic development be deferred until completion of the lateral canal in the interest of navigation and that the river diversion work connected with such civic development be under the supervision of the Chief of Engineers in order to insure that the interests of interstate and foreign commerce be properly protected; and further provided that local interests hold and save the United States free from any claims for damages that might be incurred due to the construction, maintenance, or operation of such civic development or any part thereof (H. Doc. No. 231, 76th Cong., 1st sess.).

Terminal facilities.—The water terminal and transfer facilities of

Terminal facilities.—The water terminal and transfer facilities of the district are fully described as of December 31, 1918, in House Document No. 652, Sixty-sixth Congress, second session, pages 1211—1239. Additional data for terminal facilities are also contained in Transportation Series No. 2, 1929, Transportation in the Mississippi and Ohio Valleys.

Operations and results during fiscal year.—River stages were favorable to construction work, which was carried on extensively by contract and by hired labor with Government plant during the fall of 1938; river conditions were generally unfavorable during the spring of 1939 and work was carried on only intermittently. Regulating works were maintained and project dimensions of channel were secured by dredging. The district's standard specifications for construction work were used. Location, quantities, and costs of open river regulating works follow:

Class of work and locality	Miles		Dikes (hurdles)		
and locality	of Ohio River	Num- ber	Linear feet	Cost	
New work by contract:  Price Landing Devilt Island-Schenimann-Willard Hanging Dog Island Kaskaskia Island-Ste, Genevieve Ste, Genevieve, Ill. and Mo Fish Bend Fish Bend-Danby Landing Calico Island-Cornice Island Calico Island-Sulphur Springs	27 62 68 116 123 186 143 149 164	5 x 3 8 2 4 8 4 6	2, 186 4, 335 3, 196 5, 070 2, 130 4, 925 4, 810 2, 074 3, 625	\$71, 963, 30 106, 864, 51 53, 462, 41 116, 661, 10 42, 177, 86 124, 376, 96 91, 344, 38 62, 278, 45	
Total		48	81, 850		
New work by United States plant and hired labor: Brooks Point. Grayaborn !! Liberty Bend; Sto. Generate, III. Establishment Island.	25 42 98 123 182	7 1	1, 418 840 1, 260 780	65 027 A	
Total	wed. IS.	16		194, 189, 81	
Aintenance by United States plant and hired labor.  Selid dikes,		1	5,090	120, 198, 92	

	Miles		·	Bank prote	ction (reve	tmente)		
Class of work and locality	mouth of Ohio River	mouth of Ohio Nur	onth Ohio Num-		Square (100 square feet)		Toe piles, hank protec-	G-4
			tion .	Matirow		tion, linear feet	Cost	
New work by contract: Price Landing-Powers Island-Goose Island Cape Girardeau Wilkinson-Liberty Bend	30-39 56 85-100	3 (1)	3, 145 1, 995 (*)	3, 565 1, 955 (*)	1, 649 690 519	2, 230	\$80, 082, 4 48, 115, 5 12, 119, 1	
Total		4	5, 140	5, 540	2,856	2, 230	140, 817, 14	
New work by United States plant and hired labor: Grand Lake. Kaskaskia Island.	13 11 <b>8</b>	1	1,000	328	100 612	375 1,000	9, 677, 16 17, 534, 68	
Total.		2	1,410	328	781	1, 875	27, 211, 84	
Maintenance by United States plant and hired labor.						10, 645	166, 261, 06	

E Reported fiscal year 1988.

Regular funds—New work.—Sixteen dikes, totaling 5,220 feet in length, were built by hired labor with Government plant, at a cost of \$194,159.31. Two revetments, totaling 1,410 feet in length, consisting of 328 squares of mattress and 781 squares of paving, were built by hired labor with Government plant at a cost of \$27,211.84. A total of 49,732 cubic yards of rock was removed by United States dipper dredge at a cost of \$63,557.07. Forty-eight dikes, totaling 31,850 feet in length, were built under contract at a cost of \$718,323.88. Three revetments, totaling 3,145 feet in length, consisting of 3,585 squares of mattress and 2,168 squares of paving, were built under contract at a cost of \$92,201.57. In addition to completed work there was under construction, by contract, one revetment, to total about 2,855 linear feet. The total cost of new work with regular funds was \$1,095,453.67.

Maintenance.—Dikes and revetments were repaired at a cost of \$286,456.99. The required 9-foot channel was maintained, except for the short periods needed to move a dredge to the shoal, by five United States hydraulic dredges. During the year 53 shoals developed, of which 49 were dredged once, 2 were dredged twice, 1 was dredged 3 times, and 1 was dredged 4 times. There were 7,971,257 cubic yards of sand and gravel removed by these dredges from channels through 53 bars; 556,673 cubic yards of material was removed in outside-the-channel dredging, and 128,630 cubic yards of material was removed in miscellaneous snagging operations by dipper and hydraulic dredges. The channels dredged had a combined length of 25.7 miles, an average width of 330 feet, and an average gain in depth of 6 feet. The total cost of dredging was \$570,386.02, all charged to maintenance.

Hydrographic surveys were made covering 270 miles of river, costing \$96,882.32. Model studies were made at Waterways Experiment Station, Vicksburg, Miss., of the following river reaches: Boston Bar, Dogtooth Bend, Swiftsure, and Chain of Rocks, at a total cost of \$24,218.60. Other miscellaneous costs were: Snagging, \$51,119.31; aids to navigation, \$456.82; and gages, \$8,479.03, all charged to maintenance. The total cost of all maintenance was \$1,037,999.09.

Emergency Relief funds—New work.—One revetment, totaling 1,995 linear feet, consisting of 1,955 squares of mattress and 690

squares of paving, was completed under contract at a cost of \$48,-115.57, completing all work under Emergency Relief funds.

Costs and expenditures—All funds.—The costs and expenditures during the fiscal year were as follows:

Kind of funds				
	New work	New work Maintenance Total		Expenditures
Regular	\$1,095,458,67 48,115.67	\$1, 087, 999, 09	\$2, 183, 452.76 48, 118.57	\$2, 082, 057, 16 80, 964, 57
Total	1, 143, 569. 24	1, 087, 999, 09	2, 181, 566. 23	2, 118, 011, 7

Condition at end of fiscal year.—Open river regulation works are about 77 percent completed. The quantities required to complete the project are estimated as 100 dikes, 74,000 linear feet, and 44 revetments, 210,000 linear feet. Dikes and revetments are now in very good repair and the channel has been greatly improved by the work that has been done. Dredging is required at low stages to remove temporary shoals and maintain the required channel depths.

In recent years, notwithstanding the unusual low water that has prevailed, the project dimensions of channels have generally been maintained throughout the navigation season. The navigation season formerly extended from the middle of February to the middle of December, the river being generally closed by ice the remainder of the year. However, in recent years navigation has continued throughout the winter, except when the river is actually blocked by heavy running ice or gorges. The river is generally above the 10-foot stage, St. Louis gage, for 5½ months of the year, latter part of February to middle of August, during which time project channel depths generally prevail without dredging.

The following table gives condition of the channel during the fiscal year 1989:

1		Channel affording—								
	Length of sec- tion	9 feet or more Less than 9		n 9 feet	9 feet or less		d feet or less		Con-	
		Length	Peri-	Length	Peri- od	Longth	Peri-	Length	Peri-	depth
Ohio River to Commer- cial Point Commercial Point to	Miles 32.7	Miles 81.4	Days 360	Miles 1.8	Days 5	Miles	Days	Miles	Deys	; !
Commerce to Grays	0.7	5.2	360	1.5	8			0	Ò	8.4
Point.	6.6	6.2	364	.4	1	0	0		0	7.1
Tower to Fort	88.7	29. 8	844	8.9	21	1,0	4 4	1.2		. •
Gage to Little	36, 3	35.0	357	1.8	8	.4				
Rock ttle Rock to River des	9.5	8.8	302	1.2						7
Peres yer des Peres to Mer-	46. 5	44.0	856	2.5	9	0	11:01			i Belle Site i
erghants Bridge to	11.2	11, 2	366	0	0	0	0	0		7
city of St. Louis 3. orthern boundary to	8.0	6.8	300	1.2	5	4	1.	1.3 /	1	· ·
mouth of Missouri	2.8	8.4	302	.4		(1)	-13:11 <b>0</b> 14	ng Age	order Tollands National S	, <b>7</b>

Provious tables were computed on a navigation season of 275 days. (19.5 cm) (19.5 cm)

The costs and expenditure				_	in a	
The costs and expenditures 1939, have been as follows:	unaer	the	existing	project	to June	<b>3</b> 0,
The state of the s			•		• •	1.

Kind of funds				
Kind of rands	New work	Maintenance	Total	Expenditure
Regular. Public Works. Emergency Relief	\$28, 487, 155, 34 3, 462, 154, 46 996, 747, 95	<b>\$22, 042, 165, 77</b>	\$50, 529, 321, 11 3, 462, 154, 46 996, 747, 95	\$50, 393, 595, 6 3, 492, 154, 6 996, 747, 6
Total.	32, 946, 057. 75	22, 042, 165. 77	54, 988, 223, 52	· ·
Proposed operations.—' follows: Accounts payable June 30, 193 Administration funds to be	A Abdus			, 1
New work; By contract (completion July 1, 1939, to Sept. 30 Bank protection; P Island-Goose Island By contract, July 1, 1939, Piling dikes; Giboney Island Schenimann	of existing c , 1939: rice Landin l to June 80, 1	ontract), g-Powers 940:	== 1, 000, 00 1, 800, 00	\$135, 756. O
			4, 000, 00 6, 000, 00	
Chester Fort Chartres Fish Bond Dauby I		<u>5</u>	9, 800, 00	
			3, 000, 00 9, 600, 0 <b>0</b>	•
Bank protection: Dog	ooth Bend	8	0, 000. 00	
By hired labor with Unite 1, 1939, to June 30, 1940 Bank protection, Dogte Crib dikes, Thebes Re Piling dikes, Calico I Rock removal, Graysb	ooth Bend	8: 40	1, 000, 00 5, 000, 00 0, 800, 00 6, 000, 00	171 900 00
Total, new work			-	171, 800. 00
mintenance: By hired labor plant, July 1, 1939, to June 20	1 TENA/3 4			777, 000. 00
Dikes and bank protection. Project channel dredging			, 800. 00	
Snagging Aids to navigation		701 15	, 000, 00 , 000, 00	S
Aids to navigation Surveys, tests, and studies_		10	C00. 00	•
			, 016. 91	•,.
Total maintenance			{	44, 816. 91
Total for all work				
The sum of \$2,300,000 can ar 1941, as follows:	be profital	oly expende	d during	the fiscal
w_work:				
By contract, July 1, 1940, to	June 30, 1943	1:		
Dikes Bank protection By hired labor:			\$300, 000 500, 000	^
Dikes			400 000	•
Dikes Bank protection			100,000	
			~~~, VVV	
Total, new work			-	•

Walatana				-où miert	1118
Maintenance by Dikes and Project char Surveys an	hired labor bank protect anel dredging d studies	with United	States plant	: \$450, 0	00
Wate 1 mag	Intonone			100, 0	00 ·
Total ing	mreusuce				<b>\$1, 8</b> 00, 000
Total for	all work				2, 800, 000
It is expect will be 80 per	.cu lhat. w	TIED the ne	oposed exp	enditures,	the project
•	Ooi	st and Ananc	ial summary		
	MAINTEN	ANCE AND IM	PROVEMENT F	UNDS	
Cost of new work. Cost of maintens	k to Tuno go	1000			38, 559, 909, 80 22, 042, 185, 77
Total cost Minus accounts	of permaner payable June	nt work to J 80, 1939	une 80,.1939		55, 601, 475, 57 185, 759, 00
Net total Unexpended bala	expenditures nce June 80,	1989			5, 465, 719, 48 1, 856, 619, 00
Total amou	int approprie	ated to June	30, 1989	5	7, 822, 882. 48
Fiscal year ending June 30	1935	1936	1987	1998	1939
Cost of new work	899, 974, 77	\$41, 597, 15 644, 152, 00	\$1,029,356.40 1,217,414.09	\$865, 664. 99 1, 227, 420. 75	\$1,098,488,67 1,087,999,09
Total cost	933, 322, 75	685, 749, 15	1	2, 098, 085, 74	2, 133, 489, 76
Total expended		368, 365, 18	2, 232, 5,18, 82	2, 138, 338, 29	2.082,067.16
Allotted	-2, 289, 481. 38	2, 304, 940, 52		8, 748, 000. 00	1, 875, 000. 00
Balance unexpend Amount allotted f propriation Act Amount allotted f propriation Act	rom War De approved Ju- rom War De approved Ju-	epartment Ci ne 11, 1988 epartment Ci ne 28, 1989	vil Ap- 1, 570	0, 000, 00 5, 000, 00	, 875, 000, 00
manus cap	be accounted ended			8 2	, 918, 670, 16 , 062, 067, 16
Balance une Outstanding liabili Amount covered by	xpended Jun	e 80, 1989		1	856, 613, 00
Balance avai	lable June 3	∩ 1080			185, 160. 78
Amount (estimated	1 Fourthead A.	• <b>b</b> = •••••			
				<b>4</b> ,	200,000,00
Amount that can by June 80, 1941; For new work For maintenan	1	exhended. III	Decai year	ending ( ) say	Toping to the
For maintenan	CO	*		1,	800, 000, 00
Total 1. 2 Exclusive of availa	ble funds,	The even state and the male is the send is still state and is send in the send in the send is send in the send is send in the	,	2,	800, 000, 00

#### EMERGENCY RELIEF FUNDS

Cost of maintenance to					
Total cost of pe					996, 747. 9
Net total expenditure Unexpended balance J	s une 30, 1939	)			996, 747, 94 960, 00
Total amount ar					
Fiscal year ending June 30	1935	1936	1937	1939	
Cost of new work. Cost of maintenance. Total expended.				_	
Total expended		. 639, 226, 8	3 306, 566, 5	15	50, 954, 8
Total expended	\$1,000,000				-2, 292, 0
Balance unexpended Ji Deductions on account Net amount to be Gross amount expended	Becommend	or amoun	ent		\$54, 206, 62 2, 292, 05 51, 914, 57
					50, 954, 57
Balance unexpen					960, 00
CONSQLIDATED COST AND	PINANCIAL	BUMMARY— BOURI RIVE	-MISSISSIPP	I BIVER, OH	IO RIVER TO
CASE OF UCA MILE LY IN	00 4000				
Total cost of pern Minus accounts payable	navent work June 80, 19	to June 80	0, 1939	22, 56,	598, 228, 52 135, 756, 09
Total cost of pern Minus accounts payable	navent work June 80, 19;	to June 80	0, 1939		598, 228, 52 135, 756, 09
Total cost of pern Minus accounts payable	nauent work June 80, 198 itures ne 80, 1980	to June 86	0, 1939		042, 165, 77 598, 228, 52 135, 756, 09 462, 467, 43 857, 573, 00
Total cost of perm Minus accounts payable Net total expend Jnexpended balance Jur	nauent work June 80, 198 itures ne 80, 1980	to June 86	0, 1939		042, 165, 77 598, 228, 52 135, 756, 09 462, 467, 43 857, 573, 00
Total cost of pern Minus accounts payable Net total expend Unexpended balance Jur Total amount app  Fiscal year ending June 30  ost of new work	navent work June 80, 198 itures ne 80, 1980 ropriated to	to June 80, 39	0, 1939	22, 56, 56, 1, 58,	042, 165. 77 598, 228. 52 135, 756, 09 462, 467. 43 857, 573. 00 820, 040. 48
Total cost of pern Minus accounts payable Net total expended Junexpended balance Jun Total amount apport Fiscal year ending June 30 ost of new work. ost of maintenance. Total cost.	nauent work June 30, 193 itures ne 30, 1980 ropriated to  1935  \$593, 879, 18 899, 974, 77 1, 493, 853, 95	to June 80, 39  June 30, 16  1936  \$805, 110, 11 644, 152, 00  1, 449, 262, 11	0, 1939	22, 56, 56, 1, 58, 1938	042, 165. 77 598, 228. 52 135, 756. 09 462, 467. 43 857, 573. 00 820, 040. 48  1939  \$1,143,569.24 1,037,999.09
Total cost of pern Minus accounts payable Net total expended Unexpended balance Jur Total amount apport Fiscal year ending June 30 Sect of new work Cost of maintenance Total cost.  Total cost.	nauent work June 30, 193 itures_ ne 30, 1930_ ropriated to  1935 \$593, 879, 18 899, 974, 77 1, 493, 853, 95 -1,435,477, 18	June 30, 10  1936  \$805, 110, 11 644, 152, 00 1, 449, 262, 11	1939 1937 \$1,313,493,57 1,217,414.09 2,530,907,66	22, 56, 56, 1, 58, 1938 \$855,664,99 1,227,420.75 2,093,085.74	042, 165, 77 598, 228, 52 135, 756, 09 462, 467, 43 857, 573, 00 820, 040, 48  1939 \$1,143,569,24 1,037,999,09 2;181,568,33
Net total expended unexpended balance Jur Total amount apportunity of the Price of	nauent work June 30, 193 itures_ ne 30, 1980_ ropriated to  1935  \$593, 879, 18 899, 974, 77  1, 493, 853, 96  -1,435,477,18  -664, 481, 38	to June 80, 39  June 30, 10  1936  \$805, 110, 11 644, 152, 00 1, 449, 262, 11 1, 123, 032, 80 2, 224, 714, 51	0, 1939 1937 \$1, 313, 493, 57 1, 217, 414, 09 2, 530, 907, 66 2, 539, 000, 87	22, 56, 56, 1, 58, 1938 \$655,664,90 1,227,420.75 2,093,085.74 2,138,338.29 3,745,000.00	042, 165, 77 508, 228, 52 135, 756, 09 462, 467, 43 857, 573, 00 820, 040, 48  1939 \$1, 143, 569, 24 1, 037, 999, 09 2, 181, 568, 33 2, 113, 011, 73 1, 872, 707, 95
Total cost of pern Minus accounts payable  Net total expended Unexpended balance Jur  Total amount apport  Fiscal year ending June 30  cost of new work cost of maintenance  Total cost  otal expended  liotted.	nauent work June 30, 193 itures ne 30, 1930_ ropriated to  1935 \$593, 879, 18 899, 974, 77 1, 493, 853, 95 -1,435,477,18 -664, 481, 38  7 1, 1938_ 7 1, 1938_ 7 2 Department June 11 7 2 Department June 28, 10 punted for revocation	to June 80, 39	0, 1939 1937 \$1, 313, 493, 57 1, 217, 414, 09 2, 530, 907, 06 2, 539, 066, 87 Ap- \$300, Ap- 1, 575,	22, 56, 56, 1, 58, 1938 4865, 664, 90 1, 227, 420, 75 2, 093, 085, 74 2, 138, 338, 29 3, 745, 000, 00 \$2, 000, 00 1, 8	042, 165. 77 598, 228, 52 135, 756, 09 462, 467, 43 857, 573, 00 820, 040, 48  1939  \$1, 143, 569, 24 1, 037, 999, 09 2, 181, 568, 33 2, 113, 011, 73 1, 872, 707, 95  097, 876, 78 75, 000, 00 72, 876, 78 2, 292, 06

Outstanding liabilities June 20, 1989  Amount covered by uncompleted contracts	\$98, 960, 58 86, 200, 25	ing and the second
Delenie von Service	10 g 4 t 1 a s	<b>\$185</b> , 160. 78
Balance available June 30, 1989		1, 672, 412, 22
Amount (estimated) required to be appropriated for of existing project.	completion	
June 30, 1941:	ear ending	de june sej
For maintenance		1,000,000,00 1,300,000,00
Total 1		2, 300, 000. 00
Exclusive of available funds.  2. MISSISSIPPI RIVER REVIEWERS ACCUMENTS OF THE PROPERTY OF THE	,	, 500, 000, 00

2. MISSISSIPPI RIVER BETWEEN MOUTH OF MISSOURI RIVER AND CLARKSVILLE, MO.

See report, "Mississippi River between the Missouri River and Minneapolis, Minn.," page 1146.

3. REMOVING SNAGS AND WRECKS FROM THE MISSISSIPPI RIVER BELOW THE MOUTH OF MISSOURI RIVER AND FROM OLD AND ATCHAFALAYA RIVERS

The section of the Mississippi River covered in this report was formerly in charge of the St. Louis engineer district, but for the purpose of administration on July 1, 1930, it was divided into three reaches, which are under the supervision and direction of the district engineers at St. Louis, Mo., Memphis, Tenn., and Vicksburg, Miss.

The St. Louis district extends from the mouth of the Missouri River to the mouth of the Ohio River, a distance of 195 miles. The Memphis district extends from the mouth of the Ohio River to the mouth of the Arkansas River, a distance of 399 miles. The Vicksburg district extends from the mouth of the Arkansas River to the Head of Passes, 671 miles, and includes 8 miles of Old River and 30 miles of the Atchafalaya River.

District engineers: St. Louis, Mo., Lt. Col. P. S. Reinecke, Corps of Engineers; Memphis, Tenn., Maj. Daniel Noce, Corps of Engineers; Vicksburg, Miss., Lt. Col. Raymond G. Moses, Corps of Engineers.

Division engineers: For the river below the mouth of the Ohio, Brig. Gen. H. B. Ferguson, Corps of Engineers; for the river above the mouth of the Ohio, Lt. Col. Malcolm Elliott, Corps of Engineers; Lt. Col. Philip B. Fleming, Corps of Engineers, acting May 1 to June 8, 1989.

Location.—The snagging district embraces that portion of the river between Head of Passes and the mouth of Missouri River, 1,265 miles, 8 miles of Old River (present mouth of Red River), and 30 miles of Atchafalaya River from Red River to Melville, La.; total, 1,808 miles.

Previous projects.—For the removal of these obstructions general appropriations were made at irregular intervals as early as 1824. For further details, see page 1880, Annual Report for 1915.

Existing project.—This is a continuation of the plan adopted in 1879, and provides for the removal and destruction of snags, wrecks, drift heaps, and other obstructions to navigation in the Mississippi River have the plan adopted to make the plan adopted to the plan adopted River between Head of Passes (18 miles from mouth of South Pass) and mouth of Missouri River, and in Old and Atchafalaya Rivers

#### IMPROVEMENTS-continued

<ol> <li>Examinations, surveys, and contingencies (general):</li> <li>Plant allotment</li> </ol>	1100	14. Harrisonville and Ivy Landing drainage and layer
Flood-control projects		district No. 2, Illinois 1141 15. Columbia drainage and levee
<ul> <li>6. East Cape Girardeau and Clear Creek drainage district, Illinois</li> <li>7. North Alexander drainage</li> </ul>	1130	1142 district No. 3, Illinois 1142
8. Clear Creek drainage and levee district. Illinois	1131 1133	17. East St. Louis and vicinity
9. Miller Pond drainage and levee district. Illinois	1135	Illinois 1145 18. Seahorn drainage and levee
10. Perry County drainage and levee districts, Nos. 1, 2,		district, Illinois 1147 19. Upper Mississippi River
11. Kaskaskia Island drainage and levee district. Illinois	1136	20. Preliminary examinations and surveys for flood con-
io. Fort Chartres and Ivy Land-	1139	21. Other flood-control projects for which no estimates are
ing drainage district No. 5, Illinois	1140	submitted 1151

### 1. MISSISSIPPI RIVER BETWEEN THE OHIO AND MISSOURI RIVERS

Location.—The Mississippi River rises above Lake Itasca, Minn., and, from that lake, flows in a southerly direction about 2,450 miles, and empties into the Gulf of Mexico. The portion included in this report embraces the 195-mile section known as the middle Mississippi, between the tributary Ohio and Missouri Rivers, about 1.081 to 1,276 miles from the Gulf.

Previous projects.—The original project for the improvement of the Mississippi River between the Ohio and Missouri Rivers was recommended by a Board of Engineers in a report, dated April 13, 1872, and concurred in by the Chief of Engineers. For further details see page 1879 of the Annual Report for 1915 and page 1014 of the Annual Report for 1938.

Existing project.—This provides for obtaining and maintaining a minimum channel depth of not less than 9 feet, a minimum width of not less than 300 feet at low water, with additional width in bends from the mouth of the Ohio River (about 1,081 miles from the Gulf) to the northern boundary of the city of St. Louis, 191 miles; thence 200 feet wide, with additional width in bends to the mouth of the Missouri River, 4 miles; all to be obtained by regulating works and dredging: First, by regulating works, for closing sloughs and secondary channels, and narrowing the river; by building new banks where the natural width is excessive and protecting new and old banks from erosion where necessary to secure permanency. Second, by dredging or other temporary expedients to maintain channels of project dimensions.

The estimated cost of new work, revised in 1934, is \$43,000,000,

with \$1,300,000 for annual maintenance.

The existing project was authorized by the following river and harbor acts:

Acts	Work authorized	Documents
June 3, 1896	Project for regulating works adopted in 1881. (To obtain a minimum depth of 8 feet.)	Annual Report, 1881, p. 1536.
June 13, 1902 Mar. 2, 1907	Dredging introduced as part of the project.	
Mar. 3, 1905 i Mar. 2, 1907 i	These acts practically abrogated that part of the project for the middle Mississippi which proposed regulating works.	
June 25, 1910	Regulating works restored to the project and appropriations begun with a view to the completion of the improvement between the Ohio and Missouri Rivers within 12 years at an estimated cost of \$21,000,000, exclusive of amounts previously expended.	H. Doc. No. 50, 61st Cong., 1st sess and H. Doc. No. 168, 58th Cong. 2d sess.
an; 21, 1927	For a depth of 9 feet and width of 300 feet from the Ohio River to the northern boundary of the city of St. Louis, with the estimated cost of maintenance increased to \$900,000 annually.	Rivers and Harbors Committee Doc No. 9, 69th Cong., 2d sess.
1 <b>iy 3</b> , 1930	Project between the northern boundary of the city of St. Louis and Grafton (mouth of Illinois River) modified to provide for a channel 9 feet deep and generally 200 feet wide with additional width around bends, at an estimated cost of \$1,500,000, with \$125,000 annually for maintenance.	Rivers and Harbors Committee Doc. No. 12, 70th Cong., 1st sess.

i Also joint resolution, June 29, 1906.

See House Document No. 669 (76th Cong., 3d sess.) for report of Chief of Engineers dated February 27, 1940, containing a general plan for improvement of the Mississippi River between Coon Rapids Dam and the mouth of the Ohio River for purposes of navigation, power development, the control of floods, and the needs of irrigation.

Recommended modifications of project.—Under date of March 15, 1939, the Chief of Engineers recommended modifications of the existing project to approve a comprehensive plan for development of the Mississippi River at Chain of Rocks so as to provide for construction of a lateral canal at an estimated first cost to the United States of approximately \$10,290,000, with annual maintenance and operation costs of \$70,000, subject to such modification as the Chief of Engineers may find necessary when the project is undertaken; and to authorize the relocation of the river channel and reclamation of the area in Sawyer Bend for airport, park, recreational, and similar purposes at a cost to local interests of approximately \$17,555,000; provided that any modification of the present river channel required by the civic development be deferred until completion of the lateral canal in the interest of navigation and that the river diversion work connected with such civic development be under the supervision of the Chief of Engineers in order to insure that the interests of interstate and foreign commerce be properly protected; and further provided

that local interests hold and save the United States free from any claims for damages that might be incurred due to the construction, maintenance, or operation of such civic development or any part

thereof (H. Doc. No. 231, 76th Cong., 1st sess.).

Terminal facilities.—The water terminal and transfer facilities of the district are fully described as of December 31, 1918, in House Document No. 652, Sixty-sixth Congress, second session, pages 1211-1239. Additional data for terminal facilities are also contained in Transportation Series No. 2, 1929, Transportation in the Mississippi and Ohio Valleys.

Operations and results during fiscal year.—River stages were favorable to construction work, which was carried on extensively by contract and hired labor with Government plant during the fall of 1939; river conditions were generally unfavorable during the spring of 1940 and work was carried on only intermittently. Regulating works were maintained and project dimensions of channel were secured by dredging. The district's standard specifications for construction work were used. Location, quantities, and costs of open river regulating works follow:

Class of work and locality		Dikes (hurdles)			
- The state of the	mouth of Ohio River	Num- ber	Linear feet	Cost	
Now work by contract: Giboney Island Subaniment			<del></del>		
		7	4, 030	\$78, 712. 7	
	63	11	2, 675	76, 122, 3	
		4	1,600	53, 835, 36	
Kaskaskia Island-Ste. Genevieve		1	705	16, 233, 18	
Fort Chartres	111	1	320	8, 721, 1	
Fort Chartres Fish Bend-Danby Landing	130	5	1, 525	71, 205, 38	
	138	5	3, 520	20, 244, 74	
Total				-0, 217, /4	
		34	14, 375	334, 074, 94	
New work by United States plant and hired labor:		=		0021017.01	
120EGGGH DOM !		- 1			
	23	3	1,990	84, 403 20	
	25	2	140	4, 713, 75	
I DUNGS INCHER	36			358, 26	
	42	I	1,500	45, 032, 14	
Calico Island	87	3	400	10, 739, 45	
	149	2	2, 335	51, 631, 98	
Total		11			
			6, 365	199, 908 78	
faintenance by United States plant and hired labor		]	12,484	1 182, 168, 16	

I Includes cost of screening 12,930 linear feet of dikes with lumber mattress.

	Miles		1	Bank protec	tion (rev	etments)	
Class of work and locality	above mouth of Ohio River	Num- ber	Dank	Square square		Toe piles, bank pro- tection,	Cost
			protee- tion	Mattress	Paving	linear feet	
New work by contract: Price Land- ing-Powers Island-Goose Island	34-37	2	3, 085	3, 394	1, 930	2, 025	\$84, 621, 3
New work by United States plant and		===;	=====			=====	φον, 021. δ
mred labor: Kuskaskia Island	155	1	975	877	131		11, 286, 46
Maintenance by United States plant and hired labor			15, 237	5, 741	3, 740	9, 660	203, 981. 77

New work.—Eleven dikes, totaling 6,365 feet in length, were built by hired labor with Government plant, at a cost of \$199,908.78. One revetment, totaling 975 feet in length, consisting of 877 squares of mattress and 134 squares of paving, was built by hired labor with Government plant, at a cost of \$11,286.46. A total of 41,482 cubic yards of rock was removed by United States dipper dredge at a cost of \$56,763.67. Thirty-four dikes, totaling 14,375 feet in length, were built under contract at a cost of \$334,074.94. Two revetments, totaling 3,085 feet in length, consisting of 3,394 squares of mattress and 1,930 squares of paving, were built under contract at a cost of \$84,-621.38. In addition to completed work there was under construction, by contract, two dikes to total about 1,980 linear feet, and by hired labor three dikes to total about 900 linear feet. The total cost of new work was \$686,655.23 from regular funds.

Maintenance. - Dikes and revetments were repaired at a cost of \$391,-149.93. The required 9-foot channel was maintained, except for the short periods needed to move a dredge to the shoal, by five United States hydraulic dredges. During the year 78 shoals developed, of which 70 were dredged once, 7 were dredged twice, and 1 was dredged 3 times. There were 9,963,785 cubic yards of sand and gravel removed by these dredges from the channels through 78 bars; 249,629 cubic yards of material was removed in outside-the-channel dredging, and 32.245 cubic yards of material was removed in miscellaneous snagging operations by dipper and hydraulic dredges. The channels dredged had a combined length of 25 miles, an average width of 360 feet, and an average gain in depth of 5.6 feet. The total cost of dredging was

\$555,501.20, all charged to maintenance.

Hydrographic surveys were made covering 245 miles of river, costing \$72,991.65. Model studies were made at the Waterways Experiment Station, of the following river reaches: Boston Bar and Chain of Rocks at a total cost of \$6,872.92. Other miscellaneous costs were: Snagging, \$24,378.03; aids to navigation, \$4,742.94; cooperative stream gaging, \$18,400; and gages, \$18,271.29; all charged to maintenance. The total cost of all maintenance was \$1,092,307.96. The costs during the year were \$686,655.23 from regular funds for new work and \$1,092,307.96 for maintenance. The expenditures were \$2,071,694.10 from regular funds, and minus \$9.14 from Public Works funds.

Condition at end of fiscal year.—Open river regulating works are about 78 percent completed. The quantities required to complete the project are estimated at 84 dikes, 63,000 linear feet, and 43 revetments, 206,000 linear feet. Dikes and revetments are now in good repair and the channel has been greatly improved by the work that has been done. Dredging is required at low stages to remove temporary shoals and

maintain the required channel depths.

In recent years, notwithstanding the unusual low water that has prevailed, the project dimensions of channels have generally been maintained throughout the navigation season. The navigation season formerly extended from the middle of February to the middle of December, the river being generally closed by ice the remainder of the year. However, in recent years navigation has continued throughout the winter, except when the river is actually blocked by heavy running

ice or gorges. The river is generally above the 10-foot stage, St. Louis gage, for 51/2 months of the year, latter part of February to middle of August, during which time project channel depths generally prevail without dredging.

The following table gives condition of the channel during the fiscal year 1940:

	.	l	Channel affording—								
Section of	Length 9 fee		9 feet or more		Less than 9 feet		or less	6 feet or less		Con	
		Length	Peri- od i	Length	Period	Length	Period	Length	Period	ling depti	
Ohio River to Commer- cial Point Commercial Point to	Miles 32.7	Miles 25.3	Days 329.	Miles 7.4	Days 36	Miles 3. 2	Days 13	Miles 1.6	Days 5	6	
Commerce to Grays	6.7	4. 2	338	2. 5	27	1, 5	7	.4	1	6	
Point.	6. 6	4.6	356	2.0	9	.8	3	0	0	7	
rand Tower to Fort	33. 7	21. 2	313	12.5	52	7.0	17	1.2	4	5}	
Ort Gage to Little	36. 3	26.0	322	10.3	43	5. 5	16	1.5	2	6	
Rock to River	9. 5	7.6	344	2.3	21	1.6	11	1.4	6	6	
des Peres. iver des Peres to Mer-	46. 5	31.7	312	14.8	53	9.5	24	3.6	8	•	
chants Bridge erchants Bridge to	11, 2	9.9	348	1.3	17	.8	3	0	0	53 <u>4</u> 634	
City of St. Louis orthern boundary to	8.0	4. 5	309	3. 6	56	3. 5	40	1.3	12	5	
mouth of Missouri	3.8	3, 2	343	.6	22	.4	2	-0		7	

<sup>&</sup>lt;sup>1</sup> Previous tables were computed on a navigation season of 275 days; during the fall and winter (1939-40) river stages remained below zero (St. Louis gage) for 180 consecutive days, the record to date.

<sup>1</sup> Project width is 300 feet from Ohio River to northern boundary of St. Louis and 200 feet from that point to Missouri River, with additional width in bends throughout.

<sup>2</sup> This is known as the "Chain of Rocks Reach."

The costs and expenditures under the existing project to June 30, 1940, have been as follows:

Kind of funds				
	New work	Maintenance	Total	Expenditures
Regular Public Works Emergency Relief	\$29, 173, 810. 57 3, 462, 145. 32 996, 747. 95	\$23, 134, 473. 73	\$52, 308, 284, 30 3, 462, 145, 32 996, 747, 95	\$52, 465, 259. 12 3, 462, 145. 32 996, 747. 95
Total	33, 632, 703. 84	23, 134, 473. 73	56, 767, 177. 57	56, 924, 152. 39

Proposed operations.—The unexpended balance, including \$200,000 which was advanced to the plant allotment, will be applied as follows:

Accounts payable, June 30, 1940New work:	<b>\$43,</b> 025. 18
By contract (completion of existing contract)	ent.
15, 1940: Piling dikes:	cpe.
Giboney Island	
Fish Bend-Danby Landing  By hired labor with United States	11, 200, 00
	62, 000. 00
ing jobs), July 1 to Sept. 1, 1940:	
Piling dikes: Goose Island	22, 000. 00
Piling dikes:	,
Price Towhead	<b>5</b>
Ste. Genevieve, Ill  Pile and crib dikes: Calico Island County and	<b>87, 400. 00</b>
Pile and crib dikes: Calico Island-Cornice Island.	49, 500, 00 114, 400, 00
Crib dikes: Neelys LandingBank protection:	<b>52, 800, 00</b>
Greenfield Bend Willard Wilkinson	
	52, 200, 00
Fish Bend (bank rectification)  By hired labor with United States along	60, 900, 00
	92, 800, 00
	16
Piling dikes:	
Dogtooth bendGrayshoro	- 8, 250. 00
Willard	- 31, 500, 00
Grand Tower IslandRockwood	- 20, 000, 00
Rockwood Crain Island	18, 600, 00
Horsetail, EastSolid dikes: Grayshoro	- 22, 500. 00
Solid dikes: GraysboroBank protection:	8, 750. 00
Goose IslandPulltight	•
bank rectification)  Dredging: Figh Bond (for heat	£ 000 00
Dredging: Fish Bend (for bank rectification)	5, 000, 00 34, 000, 00
Total for new work	9-1 000,00
TO THE TAX STATE OF THE PARTY O	967, 300, 00
Maintenance by hired labor with United States plant, July 1, 1940, to June 30, 1941:	
1940, to June 30, 1941:	
Dikes and bank protection  Project channel dredging	212, 000, 00
Project channel dredgingSnagging	652, 000. 00
Snagging Surveys, tests and studies	15, 000. 00
Aids to nevigation	70, 000. 00
Transfer to U. S. Geological Support	15, 000. 00
gaginggarden Survey for cooperative stream	00.000.00
Total mointain	20, 000. 00
Total maintenance	984, 000. 00
Total for all work  Unallocated balance	
Unallocated balance	1, 994, 325, 18
Total	602. 86
Total	1, 994, 928. 04

## 1124 REPORT OF CHIEF OF ENGINEERS, U. S. ARMY, 1940

The sum of \$2,850,000 can be profitably expended during the fiscal year 1942, as follows:

year 1942, as follo	ws:		~ .		B cuo Hacat
New work:					
By contract, July	1, 1941, to	June 30, 1	942 :		
					\$400,000
By hired labor:					650, 000
Dikes					·
<del>-</del>					100 000
Total for 1	iew work				1, 250, 000
Maintonanas kasti		*			1, 250, 000
Maintenance by hired Dikes and bank	labor with	United Sta	ates plant:		
Dikes and bank project channel d Transfer to U. 8	redging				780, 000
Transfer to U. s	s. Geologic	al Survey	for coope	rative stre	680, 000
gaging Surveys and studi	ne				20,000
					120, 000
Total maintenar	ice				1,600,000
Total for all wo	rk				=======================================
It is expected that be about 83 percent.	with the	nuonos d			2, 850, 000
be about 83 percent	completed	l Proposed	expendit	ures, the 1	project will
_					
	Cost and	l financial	summary		
Cost of new work to Ju Cost of maintenance to	ine 30, 1940	0		1 000	- 040
Cost of maintenance to	June 30, 1	940		336 25	3, 242, 703, 84 3, 134, 473, 73
Total cost of non	manant -	.1. 4 ~			
Undistributed costs June	30, 1940 (A	dvanced to	50, 1940 Plant accor	58	8, 377, 177, 57
					200, 000. 00
Net total cost to a Minus accounts payable	June 30, 19	40 40		58	3, 577, 177, 57
Not total					43, 025. 18
Net total expendi Unexpended balance Jur	tures			58	, 534, 152, 39
	,			1,	794, 928. 04
Total amount appr	ropriated to	June 30,	1940	60	329, 080, 43
1 Cost of new work in 1936	3 reduced in	the amount	of \$9.14	017	020, 000, 40
Fiscal year ending June 30	1000				
order of the country of the so	1936	1937	1938	1939	1940
Cost of new work	1 \$805, 100. 97	\$1, 313, 403. 57	\$865, 664, 90	\$1 1/2 500 04	2000 000 00
-	644, 152, 00	1, 217, 414. 09	\$865, 664. 99 1, 227, 420. 75	\$1, 143, 569, 24 1, 037, 999, 09	\$686, 655, 23 1, 092, 307, 96
Total cost		2, 530, 907. 66	2, 093, 085. 74	2, 181, 568, 33	1, 778, 963. 19
Total expended		2, 539, 069. 87	2, 138, 338. 29	2, 113, 011. 73	2, 071, 684, 96
Allotted	2, 224, 714. 51		3, 745, 000. 00	1, 872, 707. 95	2, 009, 040, 00
			1	,	-1 000) 010, 00

Balance unexpended July 1, 1939	
	2, 010, 000, 00
Amount to be accounted for Deductions on account of revocation of allotment	960, 00
Net amount to be accounted forGross amount expended	3, 866, 613, 00 2, 071, 684, 96
Balance unexpended June 30, 1940.  Outstanding liabilities June 30, 1940.  Amount covered by uncompleted contracts	1, 794, 928. 04
	133, 167. 22
Balance available June 30, 1940	1, 661, 760. 82
Amount (estimated) required to be appropriated for comple-	8, 400, 000. 00
Amount that can be profitably expended in fiscal year ending June 30, 1942:	5, 200, 000, 00
For new work 2For maintenance 2	1, 250, 000, 00 1, 600, 000, 00
Total <sup>2</sup> <sup>2</sup> Exclusive of available funds.	2, 850, 000, 00

2. MISSISSIPPI RIVER BETWEEN MOUTH OF MISSOURI RIVER AND MINNEAPOLIS, MINN. (ST. LOUIS DISTRICT)

See report, "Mississippi River between the Missouri River and Minneapolis, Minn.," page 1152.

3. REMOVING SNAGS AND WRECKS FROM THE MISSISSIPPI RIVER BELOW THE MOUTH OF MISSOURI RIVER AND FROM OLD AND ATCHAFALAYA RIVERS

The section of the Mississippi River covered in this report was formerly in charge of the St. Louis engineer district, but for the purpose of administration on July 1, 1930, it was divided into three reaches, which are under the supervision and direction of the district engineers at St. Louis, Mo., Memphis, Tenn., and Vicksburg, Miss.

The St. Louis district extends from the mouth of the Missouri River to the mouth of the Ohio River, a distance of 195 miles. The Memphis district extends from the mouth of the Ohio River to the mouth of the Arkansas River, a distance of 399 miles. The Vicksburg district extends from the mouth of the Arkansas River to the Head of Passes, 671 miles, and includes 8 miles of Old River and 30 miles of the Atchafalaya River.

District engineers: St. Louis, Mo., Col. P. S. Reinecke, Corps of Engineers; Memphis, Tenn., Lt. Col. Daniel Noce, Corps of Engineers; Vicksburg, Miss., Lt. Col. Raymond G. Moses, Corps of En-

Division engineers: For the river below the mouth of the Ohio, Brig. Gen. H. B. Ferguson, Corps of Engineers, to September 1, 1939; Brig. Gen. Max C. Tyler, Corps of Engineers, since that date;

### 1. MISSISSIPPI RIVER BETWEEN THE OHIO AND MISSOURI RIVERS

Location.—The Mississippi River rises above Lake Itasca, Minn., and from that lake flows in a southerly direction about 2,450 miles and empties into the Gulf of Mexico. The portion included in this report embraces the 195-mile section known as the middle Mississippi, between the tributary Ohio and Missouri Rivers, about 1,081 to 1,276 miles from the Gulf.

Previous projects.-The original project for the improvement of the Mississippi River between the Ohio and Missouri Rivers was recommended by a board of engineers in a report, dated April 13, 1872, and concurred in by the Chief of Engineers. For further details see page 1879 of the Annual Report for 1915 and page 1014 of the Annual Report for 1938,

Existing project.—This provides for obtaining and maintaining a minimum channel depth of not less than 9 feet, a minimum width of not less than 300 feet at low water, with additional width in bends from the mouth of the Ohio River (about 1,081 miles from the Gulf) to the northern boundary of the city of St. Louis, 191 miles; thence 200 feet wide, with additional width in bends to the mouth of the Missouri River, 4 miles; all to be obtained by regulating works and dredging: First, by regulating works, for closing sloughs and secondary channels, and narrowing the river; by building new banks where the natural width is excessive and protecting new and old banks from erosion where necessary to secure permanency. Second, by dredging or other temporary expedients to maintain channels of project dimensions.

The estimated cost of new work, revised in 1934, is \$43,000,000, with \$1,300,000 for annual maintenance. The existing project was authorized by the following river and harbor acts:

Acts	Work authorized	Documents
June 3, 1896	1.3	The state of the s
June 13, 1902 Mar. 2, 1907	Dredging introduced as part of the project	
Mar. 3, 1905 1 Mar. 2, 1907 1	These sets practically abrogated that part of the project for the middle Mississippi which proposed regulating works.	
June 25, 1910	Regulating works restored to the project and appropriations begun with a view to the completion of the improvement between the Ohio and Missouri Rivers within 12 years at an estimated cost of \$21,000,000, exclusive of amounts previously expended.	H. Doc. No. 30, 61st Cong., 1st sess., and H. Doc. No. 166, 58th Cong., 2d sess.
Jnn. 21, 1927	For a depth of 9 feet and width of 300 feet from the Ohio River to the northern boundary of the city of St. Louis, with the estimated cost of maintenance increased to \$900,000 annually	Rivers and Harbors Committee Doc. No. 9, 69th Cong., 2d sess.
July 3, 1930	Project between the northern boundary of the city of St. Louis and Grafton (mouth of Illinois River) modified to provide for a channel 9 feet deep and generally 200 feet wide with additional width around bends, at an estimated cost of \$1,500,000, with \$125,000 annually for maintenance.	Rivers and Harbors Committee Doc. No. 12, 70th Cong., 1st sess.

Also joint resolution, June 29, 1906.

See House Document No. 669 (76th Cong., 3d sess.) for report of Chief of Engineers dated February 27, 1940, containing a general plan for improvement of the Mississippi River between Coon Rapids Dam and the mouth of the Ohio River for purposes of navigation, power development, the control of floods, and the needs of irrigation.

Recommended modifications of project.—Under date of March 15, 1939, the Chief of Engineers recommended modifications of the existing project to approve a comprehensive plan for development of the Mississippi River at Chain of Rocks so as to provide for construction of a lateral canal at an estimated first cost to the United States of approximately \$10,290,000, with annual maintenance and operation costs of \$70,000, subject to such modification as the Chief of Engineers may find necessary when the project is undertaken; and to authorize. the relocation of the river channel and reclamation of the area in Sawyer Bend for airport, park, recreational, and similar purposes at a cost to local interests of approximately \$17,555,000; provided that any modification of the present river channel required by the civic development be deferred until completion of the lateral canal in the interest of navigation and that the river diversion work connected with such civic development be under the supervision of the Chief of Engineers in order to insure that the interests of interstate and foreign commerce be properly protected; and further provided that local interests hold and save the United States free from any claims for damages that might be incurred due to the construction, maintenance, or operation of such civic development or any part thereof (H. Doc. No. 231, 76th Cong., 1st sess.).

Terminal facilities.—The water terminal and transfer facilities of the district are fully described as of December 31, 1918, in House Document No. 652, Sixty-sixth Congress, second session, pages 1211-1239. Additional data for terminal facilities are also contained in Transportation Series No. 2, 1929, Transportation in the Mississippi and Ohio Valleys.

Operations and results during fiscal year.—River stages were favorable to construction work, which was carried on extensively by contract and hired labor with Government plant during the fall of 1940; river conditions were generally unfavorable during the spring of 1941 and work was carried on only intermittently. Regulating works were maintained and project dimensions of channels were secured by dredging. The district's standard specifications for construction work were used. Location, quantities, and costs of open river regulating

Class of work	Class of work and locality		Miles above	I	ikes (hur	dles)
	and rocality		mouth of Ohio River	Number	Linear	Cost
New work by contract: Giboney Island. Neelys Landing * Seventy Six-Liberty. Chester. Ste. Genevieve, Mo. Sie. Genevieve, Ill. Fish Bend-Danby Landing. Calico Island-Cornice Island * Total. New work by United States plant Goose Island. Graysboro. Giboney Island. Cape Girardeau. Devils Island. Willard. Rockwood. Crain Island. Sulphur Springs, Ill. Horsetail, East. Total.  Island. Island. Island. Sulphur Springs, Ill. Horsetail, East. Total.	and bired lai	bor:	67 97 112 119 122 139 152 36 42 51 56 58 65 103 105 167	(*) 3 5 (1) 24 24 22 1 1 3 3 2 2 4 6 6 2 27	(1) 1, 200 2, 360 778 3, 255 1, 205 4, 785 13, 580 2, 000 920 920 920 920 920 1, 075 1, 620 815 980	79, 367, 8 9, 977, 2 2, 144, 1 46, 806, 3 58, 235, 6 134, 487, 1 376, 336, 1 27, 403, 22
		Ba	k protect	ion (reveta		3
Class of work and locality	Miles	Times	Squares	(100 70	a nilos	

			Ba	u <b>k</b> prote	ection (re	vetments)	
Class of work and locality	Miles above mouth of Ohio	Num-	Linear feet bank		res (100 re feet)	Toe piles, bank protec-	
	River	ber	protec- tion	Mat- tress	Paving	tion, linear feet	Cost
New work by contract:  Greenfield Bend  Willard  Wilkinson  Fish Bend  Total	2 66 85-90 142	1 2 1	1, 295 1, 800 2, 355 2, 675	1, 557 1, 800 2, 355 3, 338	1, 125 847 1, 292 1, 517	720	\$58, 389, 06 39, 412, 62 62, 205, 22 73, 103, 27
New work by United States plant and hired labor: Goose Island	39	1	425	9, 050 861	170	1,870	233, 110. 2
Pulitight	164	1 2	1, 305	704	590 760		6, 234. 34 18, 547. 09
Maintenance by United States plant and hired labor			1, 587	700	755	1, 980	24, 781, 43 28, 611, 27

New work.—Twenty-seven dikes, totaling 10,750 feet in length, were built by hired labor with Government plant, at a cost of \$250,-842.37. Two revetments, totaling 1,305 feet in length, consisting of 1,065 squares of mattress and 760 squares of paving, were built by hired labor with Government plant, at a cost of \$24,781.43. A total of 1,374,890 cubic yards of material was handled by United States dredges in preparing 5 localities for new regulating works, at a cost of \$105,652.40; 24 dikes, totaling 13,580 feet in length, were built

Reported, 1940 fiscal year.
 Crib dikes.
 Pile and crib dikes.
 Includes cost of screening 16,550 linear feet of dikes with lumber mattress.

under contract, at a cost of \$376,336.14. Five revetments, totaling 8,125 feet in length, consisting of 9,050 squares of mattress and 4,781 squares of paving, were built under contract at a cost of \$233,-110.20. In addition to completed work there was under construction by contract 7 dikes to total about 2,220 linear feet, and by hired labor, 2 dikes to total about 1,310 linear feet. The total cost of

new work was \$990,722.54 from regular funds.

Maintenance.—Dikes and revetments were repaired at a cost of \$162,372.21. The required 9-foot channel was maintained, except for the short periods needed to move a dredge to the shoal, by four United States hydraulic dredges. During the year 64 shoals developed, of which 62 were dredged once and 2 were dredged twice. There were 8,217,854 cubic yards of sand and gravel removed by these dredges from the channels through 64 bars; 124,663 cubic yards of material was removed in outside-the-channel dredging, and 58,036 cubic yards of material was removed in miscellaneous snagging operations by dipper and hydraulic dredges. The channels dredged had a combined length of 21 miles, an average width of 360 feet, and an average gain in depth of 6.2 feet. The total cost of maintenance dredging was \$439,165.65.

Hydrographic surveys were made covering 96 miles of river, costing \$32,856.69. Other miscellaneous costs were: Mooring piles, \$641.40; snagging, \$50,010.35; aids to navigation, \$12,267.32; studies at Chain of Rocks, \$3,608.18; cooperative stream gaging, \$1,420.66; and gages, \$9,487.03; a stream gaging car track, suspended from Thebes Bridge (mile 43.7) was completed by contract at a cost of \$13,221.46; all charged to maintenance. The total cost of all maintenance was \$725,050.95. The costs during the year were \$990,722.54 from regular funds for new work and \$725,050.95 for maintenance, a total of \$1,715,773.49. The expenditures were \$1,568,351.79 from regular

Condition at end of fiscal year.—Open river regulating works are about 80 percent completed. The quantities required to complete the project are estimated at 100 dikes, 50,000 linear feet, and 40 revetments, 190,625 linear feet. Dikes and revetments are now in good repair and the channel has been greatly improved by the work that has been done. Dredging is required at low stages to remove temporary shoals and

maintain the required channel depths.

In recent years, notwithstanding the unusual low water that has prevailed, the project dimensions of channels have generally been maintained throughout the navigation season. The navigation season formerly extended from the middle of February to the middle of December, the river being generally closed by ice the remainder of the year. However, in recent years navigation has continued throughout the winter, except when the river is actually blocked by heavy running ice or gorges. The river is generally above the 10-foot stage, St. Louis gage (period of record, 80 years) for 51/2 months of the year, latter part of February to middle of August, during which time project channel depths generally prevail without dredging. However, the 10 years ending June 30, 1940, have been years of unusual low water, the mean stage of river for the fiscal year 1940 being 1.97 feet, St. Louis gage. The mean stage of river for the fiscal year 1941 was 4.84 feet.

The following table gives condition of the channel during the fiscal year 1941:

		Channel affording									
Section Length of section	of sec-	of sec- vicet or		feet or more Less than 9 feet 7		7 feet or less		6 feet or less		Control-	
	Length	Peri- od	Longth	Peri- od	Length	Peri- od	Length	Peri-	depth		
Ohio River to Com- mercial Point. Commercial Point to	Miles 32.7	Miles 26. 3	Days 350	Miles 0.4	Days 15	Milles	Days	Miles	Days 0	7	
Commerce to Grave	6.7	5.0	354	1.7	11	.8	2	0	0	7	
Point.	6.6	5, 4	359	1.2	6	.4	1	0	o	7	
Tower to Post	33. 7	24, 9	336	8.8	29	1.4	i	0	0	•	
Gage fort Gage to Little	36. 3	30. 5	342	5.8	23	1. 2	3	.4		632	
Rock	9. 5	7.4	353	2. 1	12	0	0	0	1	6	
des Peres liver des Peres to	48. 5	36. 6	339	10.0	26	2.0	5	1	0	8	
Merchants Bridge	11.2	10.0	351	1. 2	14	.4	1	0.4	0	5)4 7	
oity of St. Louis 1	8.0	3,4	341	4.6	24	2.7	10	.8	2	6	
mouth of Missouri River 1	3.8	2.6	351	1, 2	14	.4	4	0		7	

<sup>&</sup>lt;sup>1</sup> Project width is 300 feet from Ohio River to northern boundary of St. Louis and 200 feet from that poin to Missouri River, with additional width in heads throughout.

<sup>3</sup> This is known as the Chain of Rooks Reach.

The costs and expenditures under the existing project to June 30, 1941, have been as follows:

Kind of funds		Costs						
	New work	Maintenance	Total	Expenditures				
Regular Public Works Emergency Relief. Total	·	\$23, 859, 524. 68	\$54, 217, 438, 13 3, 462, 154, 46 996, 747, 95	1 \$54, 226, 991, 25 3, 462, 145, 32 996, 747, 95				
Total	134, 816, 815, 86	23, 859, 524, 68	58, 676, 340. 54	1 58, 685, 884, 52				

<sup>1</sup> Includes \$198,380.34 transferred from previous projects costs and expenditures.

7) previous projects costs and expenditures,	
Proposed operations.—The unexpended balance will be applied as follows:	į
Accounts navable Tune 20 To44	
Accounts payable, June 30, 1941 \$30, 446, 88	
By contract (completion of material	
By contract (completion of existing contract), July 1 to Aug.	
Piling dikes;	
Savanty Sty I thank	
Seventy Six-Liberty \$55, 000	
Calico Island-Cornice Island 30, 000  Bank protection: Willard 30, 000	
Bank protection: Willard 30,000  By hired labor with United States 3,000	
By hired labor with United States plant (completion of existing jobs), July 1 to 25, 1941:	
Piling dikes: Horsetail, cast	
Piling dikes:	
Missing Sister Manager	
Missouri Sister Island-Thompson Towhead-	
Price Towhead Googs Islands 90, 600	
Brooks Point 90, 600 Price Towhead-Goose Island 90, 600 Establishment Island Fishbord 720, 750	
Chartree Fishbelle - Fort	
Crib dikes: Seventy Six 178, 500	
Crib dikes: Seventy Six 54, 000	
· ·	

New work—Continued,		
By contract, July 1, 1941, to June 80, 1942. Continued	a	•
Cairo protection	ėžo so	^
		Ų
Ste. Geneyleye, III	70,000	
and the select annual will will be stored when the analysis	30,000	)
** " " WILL OUT EDITAL !	ı,	
Piling dikes:		
Greenfield Bend	40	
Can v named inn	40	
Brooks Point	10,500	)
Willard	- 16, 200	
Neelys Landing	<b>27</b> , 000	^
Orain Island	<b>- 24, 500</b>	)
Solid dikes: Cornice Island	- 28,000	
Greenfield Bend		
Pulliabi	_ 18,000	
Pulltight	. 12,000	
Maintenance:		\$880, 550, 00
		, , , , , , , , , , , , , , , , , , , ,
By hired labor with United States plant, July 1, 1941 to June 30, 1942;		
Dikes and bank protection	\$318,600	
Surveys, tests, and studiesAids to navigation	25, 000	
Alde to mark the studies	85, 000	
Ands to havigation	20, 000	
Alds to navigationContingencies	6, 900	
Potal maintonana	_,	
· crear tristristiffilitie		
		1, 065, 000, 00
Total maintenance		
Total for all work		
Total for all workUnallocated balance		
Total for all monte		
Total for all work	خطیق ۱۳۳۰ آگان محمد محمد الله الله ۱۳۳۰ ۱۳۳۱ سال محمد محمد الله الله الله الله الله الله الله الل	1, 975, 996, 88 570, 23
Unallocated balance The sum of \$2,600,000 can be profitably expendent	خطیق ۱۳۳۰ آگان محمد محمد الله الله ۱۳۳۰ ۱۳۳۱ سال محمد محمد الله الله الله الله الله الله الله الل	1, 975, 996, 88 570, 23
Unallocated balance The sum of \$2,600,000 can be profitably expendent	خطیق ۱۳۳۰ آگان محمد محمد الله الله ۱۳۳۰ ۱۳۳۱ سال محمد محمد الله الله الله الله الله الله الله الل	1, 975, 996, 88 570, 23
Total for all work	خطیق ۱۳۳۰ آگان محمد محمد الله الله ۱۳۳۰ ۱۳۳۱ سال محمد محمد الله الله الله الله الله الله الله الل	1, 975, 996, 88 570, 23
Total for all work	خطیق ۱۳۳۰ آگان محمد محمد الله الله ۱۳۳۰ ۱۳۳۱ سال محمد محمد الله الله الله الله الله الله الله الل	1, 975, 996, 88 570, 23
Total for all work	d during	1, 975, 996, 88 570, 23 1, 976, 567, 11 g the fiscal
Total for all work	d during	1, 975, 996, 88 570, 23 1, 976, 567, 11 g the fiscal
Total for all work	d during	1, 975, 996, 88 570, 23 1, 976, 567, 11 g the fiscal
Total for all work	400, 000	1, 975, 996, 88 570, 23 1, 976, 567, 11 g the fiscal
Total for all work  Unallocated balance  The sum of \$2,600,000 can be profitably expende year 1943, as follows:  New work:  By contract, July 1, 1942, to June 30, 1943:  Dikes  Bank protection  By hired labor:  Dikes  Dikes	400, 000	1, 975, 996, 88 570, 23 1, 976, 567, 11 g the fiscal
Total for all work	400, 000	1, 975, 996, 88 570, 23 1, 976, 567, 11 g the fiscal
Total for all work	\$400,000 700,000 100,000	1, 975, 996, 88 570, 23 1, 976, 567, 11 g the fiscal
Total for all work	\$400,000 700,000 100,000	1, 975, 996, 88 570, 23 1, 976, 567, 11 g the fiscal
Total for all work	\$400,000 700,000 100,000	1, 975, 996, 88 570, 23 1, 976, 567, 11 g the fiscal
Total for all work	\$400,000 700,000 100,000	1, 975, 996, 88 570, 23 1, 976, 567, 11 g the fiscal
Total for all work	\$400,000 700,000 100,000	1, 975, 996, 88 570, 23 1, 976, 567, 11 g the fiscal
Total for all work	\$400,000 700,000 100,000	1, 975, 996, 88 570, 23 1, 976, 567, 11 g the fiscal
Total for all work	\$400,000 700,000 100,000 \$580,000	1, 975, 996, 88 570, 23 1, 976, 567, 11 g the fiscal
Total for all work	\$400,000 700,000 100,000 100,000 \$580,000	1, 975, 996, 88 570, 23 1, 976, 567, 11 g the fiscal
Total for all work  Unallocated balance  The sum of \$2,600,000 can be profitably expende year 1943, as follows:  New work:  By contract, July 1, 1942, to June 30, 1943:  Dikes  Bank protection  By hired labor:  Dikes  Bank protection  Total for new work  Maintenance:  By hired labor with United States plant:  Dikes and bank protection  Project channel dredging  Contingencies	\$400,000 700,000 100,000 100,000 \$580,000	1, 975, 996, 88 570, 23 1, 976, 567, 11 g the fiscal
Total for all work  Unallocated balance  The sum of \$2,600,000 can be profitably expende year 1943, as follows:  New work:  By contract, July 1, 1942, to June 30, 1943:  Dikes  Bank protection  By hired labor:  Dikes  Bank protection  Total for new work  Maintenance:  By hired labor with United States plant:  Dikes and bank protection  Project channel dredging  Contingencies  Survey and studies	\$400,000 700,000 100,000 100,000 \$580,000 20,000 120,000	1, 975, 996, 88 570, 23 1, 976, 567, 11 g the fiscal \$1, 300, 000
Total for all work  Unallocated balance  The sum of \$2,600,000 can be profitably expende year 1943, as follows:  New work:  By contract, July 1, 1942, to June 30, 1943:  Dikes  Bank protection  By hired labor:  Dikes  Bunk protection  Total for new work  Maintenance:  By hired labor with United States plant:  Dikes and bank protection  Project channel dredging  Contingencies  Survey and studies  Total maintenance	\$400,000 700,000 100,000 100,000 \$580,000 20,000 120,000	1, 975, 996, 88 570, 23 1, 976, 567, 11 g the fiscal \$1, 300, 000
Total for all work  Unallocated balance  The sum of \$2,600,000 can be profitably expende year 1943, as follows:  New work:  By contract, July 1, 1942, to June 30, 1943:  Dikes  Bank protection  By hired labor:  Dikes  Bank protection  Total for new work  Maintenance:  By hired labor with United States plant:  Dikes and bank protection  Project channel dredging  Contingencies	\$400,000 700,000 100,000 100,000 \$580,000 20,000 120,000	1, 975, 996, 88 570, 23 1, 976, 567, 11 g the fiscal \$1, 300, 000

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It is expected that, with the proposed expenditures, the project will be about 85 percent completed.

#### Oost and financial summury

Total cost of peri Undistributed costs June Net total cost to J	Tuna 20 104	'*************************************		·	- 40, 000, o
Minus accounts payable		*********			- 30, 446 S
Net total expendi Unexpended balance Jun	•			· 1	976, 567, 17
Total amount appr	opriated to	June 30, 1	1941	267.	421, 685, 20
Fiscal year ending June 30	1937	1938	1939	1940	1941
Cost of new work	1, 217, 414, 09	\$805, 604, 99 1, 227, 420, 75	\$1, 143, 569, 24 1, 037, 900, 00	\$686, 655, 23 1, 092, 307, 96	\$990, 722, 5- 725, 050, 9
Total cost	2, 530, 907, 66	2, 093, 085, 74	2, 181, 568, 33	1, 778, 963, 19	1, 715, 773, 49
Total expended	2, 539, 069, 87	2, 138, 338, 29	2, 113, 011, 73	2, 071, 684, 90	1, 508, 360, 93
					TI ONES, INC. III
Balance unexpended July Amount allotted from Wa approved May 23, 1941.	1, 1940r Departme	ent Civil Ar	propriation	1 Act	794, 928. 04 750, 000. 00
Balance unexpended July Amount allotted from Wa approved May 23, 1941.  Amount to be accoudross amount expended Less reimbursements collections	1, 1940 r Departme inted for	ent Civil Ar	propriation - \$1, 661, 13 - 92, 77	7. 12 6. 19	
Balance unexpended July Amount allotted from Wa approved May 23, 1941.  Amount to be accord Gross amount expended Less reimbursements collections Balance unexpended Dutstanding Habilities Toward	1, 1940 r Departme inted for cted	ent Civil Ar	\$1, 661, 13 92, 77	\$1, 'Act	704, 928. 04 750, 000. 00 544, 928. 04
Allotted  Balance unexpended July Amount allotted from Wa approved May 23, 1941.  Amount to be according amount expended.  Less reimbursements collected to the second sec	1, 1940	ent Civil Ar	\$1, 661, 13 92, 77 \$0, 63: 80, 69:	\$1, det	750, 000. 00 544, 928. 04 668, 360. 93
Allotted  Balance unexpended July Amount allotted from Wa approved May 23, 1941  Amount to be accord Gross amount expended  Less reimbursements collected  Balance unexpended  Outstanding liabilities Jun Amount covered by uncom  Balance available Junount (estimated) recent	1, 1940	ent Civil A <sub>I</sub>	\$1, 661, 13 92, 77 \$9, 53; 80, 03	7. 12 6. 19 1, 5 2, 75 0. 16	794, 928, 04 750, 000, 00 544, 928, 04 668, 360, 93 976, 567, 11
Balance unexpended July Amount allotted from Wa approved May 23, 1941.  Amount to be accord Gross amount expended.  Less reimbursements collected  Balance unexpended  Outstanding liabilities Jun Amount covered by uncom  Balance available Jun  amount (estimated) required existing project	1, 1940	941	\$1, 661, 13 92, 77 \$9, 83; 80, 03;	7. 12 6. 19 1, 8 3, 75 0, 16 1, 8 Hon 7, 8	794, 928, 04 750, 000, 00 544, 928, 04 668, 360, 93 976, 567, 11 98, 732, 91
Balance unexpended July Amount allotted from Wa approved May 23, 1941.  Amount to be accou Gross amount expended.  Less reimbursements collected in the second seco	1, 1940 r Department of the formation of the so, 1941 in the so, 1941 of the so, 1941 of the so, 1941 of the so, 1941 of the so	941propriated	\$1,661,13 92,77 \$9,83: 89,09:	\$1, det	794, 928, 04 750, 000, 00 544, 928, 04 668, 360, 93 976, 567, 11 98, 732, 91 77, 834, 20
Balance unexpended July Amount allotted from Wa approved May 23, 1941.  Amount to be accord Gross amount expended.  Less reimbursements collected  Balance unexpended  Outstanding liabilities Jun Amount covered by uncom  Balance available Jun  amount (estimated) required of existing project.  Impount that can be profit	1, 1940 r Departme inted for cted I June 30, 1 ie 30, 1941 inpleted cont ine 30, 1941 red to be ap	941 propriated ded in fisca	\$1,661, 13 92,77 \$9,83; 89,099 for completed	\$1, '\frac{1}{3}, \frac{1}{4} \\ \begin{array}{cccccccccccccccccccccccccccccccccccc	794, 928, 04 750, 000, 00 544, 928, 04 668, 360, 93 976, 567, 11 98, 732, 91 77, 834, 20

# 2. MISSISSIPPI RIVER BETWEEN MOUTH OF MISSOURI RIVER AND MINNEAPOLIS, MINN. (ST. LOUIS DISTRICT)

See report "Mississippi River between the Missouri River and Minne-apolis, Minn.," page 1128.

#### IMPROVEMENTS

	ROVEMENTS
the Ohio and Missouri	Flood control—Continued  10. Kaskaskia Island drainage
2. Mississippi River between	993 11. Columbia drainage and leuce
Minneapolis, Minn. (St.	12. Wilson and Wenkel and Prairie du Pont drainage
Louis district) (St.	13. East St. Louis and vicinity.
contingencies (general)	14. Wood River drainage and
estimates are submitted	15. Seahorn drainage and leves
	16. Meredosia Lake and Willow
Flood control	districts. Illinois River
7. East Cape Girardeau and Clear Creek drainage dis-	17. Upper Mississippi River Re-
8. North Alexander drains and 100	2 18. Preliminary examinations and
9. Clear Creek drainage and	3 19. Other flood-control projects 1016
levee district, Illinois 100	
1. MISSISSIPPI DIVER	1011

### 1. MISSISSIPPI RIVER BETWEEN THE OHIO AND MISSOURI RIVERS

Location.—The Mississippi River rises above Lake Itasca, Minn., and, from that lake, flows in a southerly direction about 2,450 miles, and empties into the Gulf of Mexico. The portion included in this report embraces the 195-mile section known as the middle Mississippi, between the tributary Ohio and Missouri Rivers, about 1,081 to 1,276 miles from the Gulf.

Previous projects.—The original project for the improvement of the Mississippi River between the Ohio and Missouri Rivers was recommended by a Board of Engineers in a report, dated April 13, 1872, and concurred in by the Chief of Engineers. For further details see page 1879 of the Annual Report for 1915 and page 1014 of the Annual Report for 1938.

Existing project.—This provides for obtaining and maintaining a minimum channel depth of not less than 9 feet, a minimum width of not less than 300 feet at low water, with additional width in bends from the mouth of the Ohio River (about 1,081 miles from the Gulf) to the northern boundary of the city of St. Louis, 191 miles; thence 200 feet wide, with additional width in bends to the mouth of the Missouri River, 4 miles; all to be obtained by regulating works and dredging: First, by regulating works, for closing sloughs and secondary channels, and narrowing the river; by building new banks where the natural width is excessive and protecting new and old banks from erosion where necessary to secure permanency. Second, by dredging or other temporary expedients to maintain channels of project dimensions.

The estimated cost of new work, revised in 1934, is \$43,000,000, with \$1,300,000 for annual maintenance.

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The existing project was authorized by the following river and harbor acts:

Acts	Work authorized	Documents
June 3, 1898 June 13, 1902 Mar. 2, 1907	Dredging introduced as your -cat	Annual Report, 1881, p. 1536.
Mar. 3, 1905 i Mar. 2, 1907 i Juno 25, 1910	These acts practically abrogated that part of the project for the middle Mississippi which proposed regulating works.  Regulating works restored to the project and appropriations begun with a view to the completion of the improvement between the Ohio and Missouri Rivers within 12 years at an estimated cost of \$21,000,000, exclusive of amounts previously expended.	H. Doc. No. 50, 61st Cong., 1st ses and H. Doc. No. 168, 58th Cong 2d sess.
an. 21, 1927	For a depth of 9 feet and width of 300 feet from the Ohio River to the northern boundary of the city of St. Louis, with the estimated cost of mainte- nance increased to \$900,000 approach.	Rivers and Harbors Committee Doo No. 9, 69th Cong., 2d sess.
uly 3, 1930	Project between the northern boundary of the city of St. Louis and Grafton (mouth of Illinois River) modified to provide for a channel 9 feet deep and generally 200 feet wide with additional width around bends, at an estimated cost of \$1,500,000, with \$125,000 annually for maintenance.	Rivers and Harbors Committee Doc No. 12, 70th Cong., 1st sess.

Also joint resolution, June 29, 1906.

See House Document No. 669 (76th Cong., 3d sess.) for report of Chief of Engineers dated February 27, 1940, containing a general plan for improvement of the Mississippi River between Coon Rapids Dam and the mouth of the Ohio River for purposes of navigation, power development, the control of floods, and the needs of irrigation.

Recommended modifications of project .- Under date of March 15, 1939, the Chief of Engineers recommended modifications of the existing project to approve a comprehensive plan for development of the Mississippi River at Chain of Rocks so as to provide for construction of a lateral canal at an estimated first cost to the United States of approximately \$10,290,000, with annual maintenance and operation costs of \$70,000, subject to such modification as the Chief of Engineers may find necessary when the project is undertaken; and to authorize the relocation of the river channel and reclamation of the area in Sawyer Bend for airport, park, recreational, and similar purposes at a cost to local interests of approximately \$17,555,000; provided that any modification of the present river channel required by the civic development be deferred until completion of the lateral canal in the interest of navigation and that the river diversion work connected with such civic development be under the supervision of the Chief of Engineers in order to insure that the interests of interstate and foreign commerce be properly protected; and further provided that local interests hold and save the United States free from any claims for damages that might be incurred due to the construction,

maintenance, or operation of such civic development or any part

thereof (H. Doc. No. 231, 76th Cong., 1st sess.).

Terminal facilities.—The water terminal and transfer facilities of the district are fully described as of December 31, 1918, in House Document No. 652, Sixty-sixth Congress, second session, pages 1211-1239. Additional data for terminal facilities are also contained in Transportation Series No. 2, 1929, Transportation in the Mississippi and Ohio Valleys.

Operations and results during fiscal year.—River stages were favorable to construction work, which was carried on extensively by contract and hired labor with Government plant during the fall of 1941; river conditions were unfavorable during the spring of 1942 and work was carried on only intermittently. A stage of 34.22 feet was recorded on the St. Louis (Market Street) gage on June 30. Regulating works were maintained and project dimensions of channels were secured by dredging. The district's standard specifications for construction work were used. Location, quantities, and costs of open river regulating

Class of work an	d locality			Miles above		Dikes (h	urdles)
		of Ohio River		er Lines			
New work by contract: Missouri Sister Island-Tho L'olut	mpson T	owhee.	l-Brooks				<u> </u>
Tide Towhead Classes Tales a				18		2 1.16	
Seventy Six !				. 34	1	2 1, 16 4 1, 68	
				85 100			1,886.3
Establishment Teleman was	******			118		2 63 7 2,22	0 21,409,1
Calico Island-Cornice Island	id-roft Ch	artres.		134	1	7 2,22 6 2,01	
Matal		******		149	1	2 1.09	0 86,420,3 5 30,145.6
Total					1-	3 8.50	
New work by United States plant : Greenfield Bend Cairo Protection	and hired l	abor:				8,80	298, 861. 4
Cairo Protection				1	1	2 610	10 000 0
DIOOKS Point				. 6	l .	l in	
William	********			24 42		340	7,994.20
Wilkinson				63		435	
Crain Island Ste. Genevieve, Ili Cornice Island				86		1.035 225	
Ste. Genevieve, Ill				106		700	
Cornice Island Horsetall, East				123 153	2	270	9, 281, 90
	• • • • • • • • • • •			167	3 2 3	1,010 1,310	
Total.		*****			19	6, 535	180, 843, 36
Maintenance by United States plan	and hired	labor.				18, 735	<sup>2</sup> 261, 899, 98
			Е	ank nente	ortion (no	vetments)-	2001000.00
	Miles	-	T			verments)	
Class of work and locality	above mouth	1	1		res (100 re (eet)		, , , , ,
•	of Ohio River	Num- ber	leet ban	k	T	Toe piles bank pro-	Cost
			protectio	Mat- tress	Paving	tection linear feet	Cont
ew work by contract: Cairo Protection							
Price Landing-Goose Island Willard	31-35	1					\$1,059.68
Willard	92	2	1, 955 51 <i>5</i>		883		67, 704. 02
	126	_ i		818	184		9, 720, 98 543, 00
Total.	******	5	2, 470	2,977	1,067		79, 027. 66
mintenance by United States plant and hired labor.			4 105				19,021.00
Pile and crib dikes.			4, 193	2,707   r mattres	7, 164.	5,310	170, 528, 15

New work.—Nineteen dikes, totaling 6,535 feet in length, were built by hired labor with Government plant, at a cost of \$180,848.36; 23 dikes, totaling 8,800 feet in length, were built under contract at a cost of \$298,861.45. Five reverments, totaling 2,470 feet in length, consisting of 2,977 squares of mattress and 1,067 squares of paving were built under contract at a cost of \$79,027.66. In addition to completed work there was under construction by contract, 20 dikes to total about 9,870 linear feet and 2 revetments totaling about 2,000 linear feet, and by hired labor, 8 dikes to total about 885 linear feet. The total cost of new work was \$558,732.47 from regular funds.

Maintenance.—Dikes and revetments were repaired at a cost of \$432,428.13. There were 3,094 cubic yards of rock removed at Beaver Dam, mile 38.4, at a cost of \$22,056.03. The required 9-foot channel was maintained, except for the short periods needed to move a dredge to the shoal, by 4 United States hydraulic dredges. During the year 86 shoals developed of which 32 were dredged once and 1 was dredged 4 times. There were 4,252,588 cubic yards of sand and gravel removed by these dredges from the channels through 36 bars; 670,440 cubic yards of material was removed in outside-the-channel dredging. The channels dredged had a combined length of 18 miles, an average width of 315 feet, and an average gain in depth of 4.7 feet. The total cost of maintenance dredging was \$263,233.25.

Hydrographic surveys were made covering 105 miles of river, costing \$77,794.91. Other miscellaneous costs were: Snagging, \$18,766.37; aids to navigation, \$19,576.78; studies at Chain of Rocks, \$1,200.20; cooperative stream gaging, \$8,810.27; and gages, \$5,403.53; flood relief, \$24,811.95; defense lighting at service base, \$17,034.92, and at Cape Girardeau fleet, \$11.59, all charged to maintenance. The total cost of all maintenance was \$891,127.93. The costs during the year were \$558,732.47 from regular funds for new work and \$891,127.93 for maintenance, a total of \$1,449,860.40. The expenditures were

\$1,594,454.40 from regular funds.

Condition at end of fiscal year.—Open river regulating works are about 82 percent completed. The quantities required to complete the project are estimated at 60 dikes, 45,000 linear feet, and 35 revetments, 147,000 linear feet. Dikes and revetments are now in good repair and the channel has been greatly improved by the work that has been done. Dredging is required at low stages to remove tem-

porary shoals and maintain the required channel depths.

In recent years, notwithstanding the unusual low water that has prevailed, the project dimensions of channels have generally been maintained throughout the navigation season. The navigation season formerly extended from the middle of February to the middle of December, the river being generally closed by ice the remainder of the year. However, in recent years navigation has continued throughout the winter, except when the river is actually blocked by heavy running ice or gorges. The river is generally above the 10-foot stage, St. Louis gage (period of record, 81 years) for 51/2 months of the year, latter part of February to middle of August, during which time project channel depths generally prevail without dredging. The mean stage of river for the fiscal year 1941 was 4.84 feet, St. Louis gage. The mean stage of river for the fiscal year 1942 was 13.60 feet.

The following table gives condition of the channel during the fiscal year 1942:

				C	bannel	affording	1	100		
Section	Length of sec- tion	9 feet o	r more	Less the	ın 9 feet	7 feet	or less	6 feet	or leas	Con- trol- ling
		Length	Period	Length	Period	Length	Period	Length	Period	depth
Ohio River to Com- mercial Point. Commercial Point to	Miles 32.7	Miles 30.8	Days 359	Miles 1.0	Days 6	Miles 0,4	Days	Miles	Days	Feet
Commerce to Grava	6.7	5.9	362	.8	3	0	0	0		7
Point.	6.6	6.6	365	0	0	- 0	0		0	8
Tower to Fort	33. 7	30.8	348	2.9	17.	.4	1			103
ort Clare to Little	36.3	36.3	365	0	0	0.		0	0	7
tle Rock to River	9.5	9,1	364	.4	1	0		0		•
ver des Peres to	46. 5	44.5	858	2.0	7	0	0	0	0	
Merchants Bridge to	11.2	11,2	365	0	0	0	0	. 0	0	734
orthern boundary bity of St. Louis 3	8.0	5.7	3.59	2.3	6	.4	1	0	0	7
mouth of Missouri	3,8	. 3.8	365					0	0	• "

<sup>1</sup> Project width is 300 feet from Ohio River to northern boundary of St. Louis and 200 feet from that point to Missouri River, with additional width in bends throughout.

<sup>2</sup> This is known as the Chain of Rocks Reach.

The costs and expenditures under the existing project to June 30, 1942, have been as follows:

Kind of funds		Costs		
	New work	Maintenance	Total	Expenditures
Regular. Public works. Emergency Relief.	\$30, 916, 645, 92 3, 462, 154, 46 996, 747, 95	\$24,750,652.61	\$55, 667, 298, 53 3, 462, 154, 46 996, 747, 95	1 \$55, 821, 445, 61 3, 462, 154, 46 996, 747, 91
Total.	25, 375, 548. 33	24, 750, 652, 61	60, 126, 200, 94	60, 280, 348, 00

Includes \$193,380.34 transferred from previous project costs and expenditures.

Proposed operations.—The unexpended balance, including \$200,000 advanced to the plant allotment, will be applied as follows:

Accounts payable June 30, 1942\_\_\_\_\_\_\_\_\$45, 852. 88

By contract (completion of existing contracts), July 1 to Sept. 30, 1942: Piling dikes:

ing dikes:	
Missouri Sister Island-Thompson Tow- head-Brooks Point	<b>9104</b> 000 00
Establishment Island Fish Bond Fort	\$194, 890. 00 152, 575. 00
Crib dikes: Seventy-Six	122, 091, 00 72, 620, 00
Cairo protection	40, 476, 00 40, 958, 00 31, 063, 00

New work—Continued.		
By hired labor with United States are		
	€ 90, 000 A	
By contract, July 1, 1942, to June 30, 1943:	Ψυ <b>σ,</b> 020. U(	,
Schenimann-Willard	77, 280, 00	1
Crib dikes: Danby Landing Bank protection:	79, 300, 00	
Cape Girardeau Wilkinson By hired labor with United State		).
	157, 500.00	
1942, to June 30, 1943:		
riling dikes:	the second state of	
Cairo protection	40 000 60	•
	16, 500, 00	·* .
Goose Island	20, 400, 00 33, 600, 00	
Giboney Island	41, 000, 00	
Calico Island Solid dikes: Seventy St	7, 650, 00	
	17, 250, 00	
		e for all
Giboney Island Willard St. Louis Harbor	26, 000, 00	
St Louis Trank	24, 000, 00	
ALGI DUI	46, 800, on	
Total for non-		•
Maintenance:	&	1, 582, 179, 00
By hired labor with Tinited States when the		
1942, to June 30, 1943:		
Ulkes and hank protection	1000 oma	
Project channel dredging	233, 250, 00	
Project channel dredging Snagging Surveys, gages, and studies	012, 500, (0)	
Surveys, gages, and studiesAids to navigation	7, 720, 00	
Aids to navigation Safeguarding structures	49, 100, 00	
Safeguarding structures	22, 100, (N)	
Safeguarding structuresCooperative stream gaging	19 400 00	
Potal metal	10, 100.00	
Total maintenance		988, 280, 00
Unallocated balance	-	200, 200, 00
Unallocated halance	:	2, 616, 311, 88
		200. 83
	· · · · · · · · · · · · · · · · · · ·	
The min of de see see		2, 616, 512, 71
The sum of \$2,300,000 can be profitably expen year 1944, as follows:	ded during	the free!
year 1944, as follows:	and diffill	ene necat
New work:		
By contract, July 1, 1943, to June 30, 1944;		•
Dikes to June 30, 1944;		
Bank protection  By hired labor	\$200, 000	
By hired labor:	500, 000	
- Dikeg		
Bank protection	150, 000	
	19U, 000	
Total for new work		AAA
Maintenance:		<b>⊉</b> 1, 000, 000
By hired labor with United States plant:		
**************************************	SKOV VOV	
Surveys and studies	120,000	
Total maintenance		1,800,000
Total for all		-, 000, 000
Total for all work		2, 300, 000
		~) UUV. UUV.

It is expected that, with the proposed expenditures, the project will be about 86 percent complete.

#### Cost and financial summary

Cost of maintenance to Total cost of per- Undistributed costs Jun	nanent work e 80, 1942	k to June 8	0, 1942	66	, 803, 425. 200, 000
Net total cost to . Minus accounts payable	June 30, 194 June 80, 19	2 942		87	, 003, 425.
Net total expend Unexpended balance Ju	ltures ne 80, 1942_	2 (500 See, upo tem 120), maj 142 giaj 142 giaj 142 giaj 14 (500 See See See, gain 142 giaj 143 giaj		<sup>1</sup> 66	957, 572, 418, 519
Total amount app	ropriated to	June 30, 1	942	<sup>1</sup> 69,	874, 085, 2
Fiscal year ending June 30	1938	1939	1940	1941	1942
Cost of new work	1, 227, 420, 75	\$1, 143, 569, 24 1, 037, 999, 09	\$686, 655, 23 1, 092, 307, 96	\$990, 722, 54 725, 050, 95	\$558, 732. 891, 127.
Total cost.	1	2, 181, 568. 33	1, 778, 963, 19	1, 715, 773.49	1, 449, 860.
otal expended	2, 138, 338. 29	2, 113, 011. 73	2, 071, 684. 96	1, 568, 360, 93	1, 594, 454.
	B 545 655	1 000 000			
salance unexpended July mount allotted from W	ar Departm ed May 23,	ent Civil A	\$24, 40	0. 00 0. 00	2, 034, 400. 976, 567. 1:
dalance unexpended July mount allotted from W propriation Act approvement allotted from W propriation Act approvement to be accompanied.	1, 1941 ar Departm ed May 23, ar Departm ed Apr. 28,	ent Civil A 1941 ent Civil A 1942	p- \$24, 40 p- 2, 010, 000	\$1, 9 0. 00 0. 00 2, 0	976, 567. 1: 084, 400. 00
Balance unexpended July mount allotted from W propriation Act approvement allotted from W propriation Act approvement to be see	1, 1941 ar Departm ed May 23, ar Departm ed Apr. 28,	ent Civil A 1941 ent Civil A 1942	p- \$24, 40 p- 2, 010, 000	\$1, 9 0. 00 0. 00 2, 0	978, 567. 1:
calance unexpended July mount allotted from W propriation Act approvement allotted from W propriation Act approvement allotted from W propriation Act approvement to be access amount to be access reimbursements collected	1, 1941 ar Departmed May 23, ar Departmed Apr. 28, ounted for_	ent Civil A 1941 ent Civil A 1942	p- \$24, 40 p- 2, 010, 000 \$1, 621, 481 27, 021	\$1,1 0,00 0,00 2,6 	976, 567, 1 984, 400, 0 910, 967, 1
lalance unexpended July mount allotted from W propriation Act approvement allotted from W propriation Act approvement to be accross amount expended—ess reimbursements collected to the second of the	1, 1941ar Departmed May 23, ar Departmed Apr. 28, ounted ford June 30,	ent Civil A 1941 ent Civil A 1942	p- 2, 010, 000 \$1, 621, 48 27, 021	\$1, 1 0, 00 0, 00 2, 0 4, 0 0, 51 5, 91 1, 5	978, 567, 1 984, 400, 0 910, 967, 1 164, 454, 40
lalance unexpended July mount allotted from W propriation Act approvement allotted from W propriation Act approvement to be accross amount expended—ess reimbursements collected to the second of the	1, 1941ar Departmed May 23, ar Departmed Apr. 28, ounted ford June 30,	ent Civil A 1941 ent Civil A 1942	p- 2, 010, 000 \$1, 621, 48 27, 021	\$1,5 0.00 2,6 4,6 0.51 5,91 1,5 2,4	976, 567, 1: 084, 400, 00 010, 967, 11 594, 454, 40
Amount to be acc ross amount expended amount allotted from W propriation Act approv mount allotted from W propriation Act approv  Amount to be acc ross amount expended ess reimbursements colle  Balance unexpende utstanding liabilities Jui mount covered by uncon  Balance available J mount (estimated) requi	1, 1941 ar Departmed May 23, ar Departmed Apr. 28, ounted for_ cted d June 30, ne 30, 1942 apleted cont	ent Civil A 1941 ent Civil A 1942  1942 racts	P- \$24, 40 P- 2, 010, 000 \$1, 621, 486 27, 021 \$24, 030 508, 427	\$1,5 0.00 2,6 4,6 0.31 5,91 1,5 2,4 7,88	976, 567. 1 934, 400. 0 910, 967. 1 94, 454. 40 16, 512. 71 32, 458. 31
Amount to be accorded subject to be accorded by a subject	1, 1941 ar Departmed May 23, ar Departmed Apr. 28, ounted for_ cted d June 30, ne 30, 1942 apleted cont une 30, 1942 red to be ap	ent Civil A 1941 ent Civil A 1942  1942  racts  propriated ded in fisca	p- \$24, 40 p- 2, 010, 000 \$1, 621, 48 27, 02 \$24, 030 506, 427 for completed	\$1, 1 0, 00 0, 00 2, 6 4, 6 0, 31 5, 91 1, 5 2, 4 1, 88 5, 91 1, 8	976, 567, 1: 934, 400, 00 910, 967, 1: 94, 454, 40 16, 512, 71 32, 458, 81 94, 054, 40
propriation Act approved Amount to be accessed amount expended—ess reimbursements colled Balance unexpended utstanding liabilities Just and liabilities Just amount covered by uncon Balance available Just amount (estimated) required existing project amount that can be profit June 30, 1944:  For new work amount appropriation of the profit June 30, 1944:	1, 1941 ar Departmed May 23, ar Departmed Apr. 28, ounted for_ cted d June 30, ne 30, 1942 apleted cont une 30, 1942 red to be ap	ent Civil A 1941 ent Civil A 1942  1942  racts  propriated ded in fisca	p- \$24, 40 p- 2, 010, 000 \$1, 621, 48 27, 022 \$24, 036 508, 427 for completed	\$1, 1 0, 00 2, 0 4, 0 0, 31 5, 91 1, 5 2, 4 1, 88 5 1, 88	978, 567, 1: 084, 400, 00 010, 967, 11

2. MISSISSIPPI RIVER BETWEEN MOUTH OF MISSOURI RIVER AND MINNEAPOLIS, MINN. (ST. LOUIS DISTRICT)

See report, "Mississippi River between the Missouri River and Minneapolis, Minn.," page 1018.

### IMPROVEMENT OF RIVERS AND HARBORS IN THE ST. LOUIS, MISSOURI, DISTRICT

This district comprises those portions of southwestern Illinois and eastern Missouri embraced in the drainage basin of the Mississippi River and its western tributaries, exclusive of the Missouri River, between the mouth of the Ohio River and mile 300 above the same, and of its eastern tributaries to Hamburg Bay at mile 261 on the left bank, exclusive of the tributary basin of the Illinois Waterway upstream of the new La Grange Lock and Dam at mile 80.15 above the confluence of the Illinois and Mississippi Rivers. The district also includes the drainage basin in Missouri tributary to the Little River Diversion Channel. Report on Mississippi River between the Missouri River and mile 300 is included in the report on Mississippi River between Missouri River and Minneapolis, Minn. Report on that portion of the Illinois River downstream of the new La Grange Lock and Dam is included in report on Illinois Waterway, Ill,, contained in the report of the district engineer, Chicago, Ill.

District engineer: Col. Roy W. Grower, Corps of Engineers, to August 4, 1942; Col. Lawrence B. Feagin, Corps of Engineers, since

Division engineer: Col. Malcolm Elliott, Corps of Engineers.

#### IMPROVEMENTS

	IMPRO	vements	
Navigation	Page	Flood control—Continued	
1. Mississippi River between the Ohio and Missouri		11. Kaskaskia Island drainage	Page
2. Mississippi River between	904	and levee district, Illinois  12. Harrisonville and Ivy Landing drainage and levee dis-	919
the Missouri River and Minneapolis, Minn. (St. Louis district)	004	13. Columbia drainage and laves	920
Louis district)	934 1381	14. Wilson and Workel	921
contingencies (general)	911	Prairie du Pont drainage and levee districts, Illinois 15. East St. Louis and vicinity,	923
5. Other navigation projects for which no estimates are submitted.	010	16. Wood River drainage and	924
6. Plant allotment	912 913	17. Seahorn drainage and levee	926
Flood control		district, Illinois  18. Meredosia Lake and Willow  Creek drainage and levee	927
7. East Cape Girardeau and Clear Creek drainage dis-		19. Upper Mississippi River	928
8. Clear Creek drainage and	914	Basin, St. Louis district 20. Preliminary examinations, surveys, and contingencies	930
9. Preston drainage and levee district, Illinois	915	21. Emergency flood-control	931
levee districts Nos 1 2	0±0	22. Other flood-control projects	932
and 3, Missouri	918	for which no estimates are submitted	934

1. MISSISSIPPI RIVER BETWEEN THE OHIO AND MISSOURI RIVERS

Location.—The Mississippi River rises above Lake Itasca, Minn., and, from that lake, flows in a southerly direction about 2,450 miles and empties into the Gulf of Mexico. The portion included in this report embraces the 195-mile section known as the middle Mississippi, between the tributary Ohio and Missouri Rivers, about 1,081 to 1,276 ntiles from the Gulf. 

Previous projects.—The original project for the improvement of the Mississippi River between the Ohio and Missouri Rivers was recommended by a Board of Engineers in a report, dated April 13, 1872, and concurred in by the Chief of Engineers. For further details see page 1879 of the Annual Report for 1915 and page 1014 of the

Annual Report for 1938.

Existing project.—This provides for obtaining and maintaining a minimum channel depth of not less than 9 feet, a minimum width of not less than 300 feet at low water, with additional width in bends from the mouth of the Ohio River (about 1,081 miles from the Gulf) to the northern boundary of the city of St. Louis, 191 miles; thence 200 feet wide, with additional width in bends to the mouth of the Missouri River, 4 miles; all to be obtained by regulating works and dredging: First, by regulating works, for closing sloughs and secondary channels, and narrowing the river; by building new banks where the natural width is excessive and protecting new and old banks from erosion where necessary to secure permanency. Second, by dredging or other temporary expedients to maintain channels of project dimensions.

The estimated cost of new work, revised in 1934, is \$43,000,000,

with \$1,300,000 for annual maintenance.

The existing project was authorized by the following river and harbor acts:

Acts	Work authorized	Documents
June 3, 1896	Project for regulating works adopted in 1881. (To obtain a minimum depth of 8 feet.)	Annual Report, 1881, p. 1526.
June 13, 1902 Mar. 2, 1907	Dredging introduced as part of the project	_
Mar. 3, 1905 1 Mar. 2, 1907 1	These acts practically abrogated that part of the project for the middle Mississippi which proposed regulating works.	
June 25, 1910	Regulating works restored to the project and appropriations begun with a view to the completion of the improvement between the Ohio and Missouri Rivers within 12 years at an estimated cost of \$21,000,000, exclusive of amounts previously expended.	H. Doc. No. 50, 61st Cong., 1st sess., and H. Doc. No. 168, 58th Cong., 2d sess.
Jan. 21, 1927	For a depth of 9 feet and width of 300 feet from the Ohio River to the northern boundary of the city of St. Louis, with the estimated cost of maintenance increased to \$900,000 annually.	Rivers and Harbors Committee Doc. No. 9, 69th Cong., 2d sess.
July 3, 1930	Project between the northern boundary of the city of St. Louis and Grafton (mouth of Illinois River) modified to provide for a channel 9 feet deep and generally 200 feet wide with additional width around bends, at an estimated cost of \$1,500,000, with \$125,000 annually for maintenance.	Rivers and Harbors Committee Doc. No. 12, 70th Cong., 1st sees.

Also joint resolution, June 29, 1906.

See House Document No. 669 (76th Cong., 3d sess.) for report of Chief of Engineers dated February 27, 1940, containing a general plan for improvement of the Mississippi River between Coon Rapids Dam and the mouth of the Ohio River for purposes of navigation, power development, the control of floods, and the needs of irrigation.

Recommended modifications of project.—Under date of March 15, 1939, the Chief of Engineers recommended modifications of the existing project to approve a comprehensive plan for development of the Mississippi River at Chain of Rocks so as to provide for construction of a lateral canal at an estimated first cost to the United States of approximately \$10,290,000, with annual maintenance and operation cost of \$70,000, subject to such modification as the Chief of Engineers may find necessary when the project is undertaken; and to authorize the relocation of the river channel and reclamation of the area in Sawyer Bend for airport, park, recreational, and similar purposes at a cost to local interests of approximately \$17,555,000; provided that any modification of the present river channel required by the civic development be deferred until completion of the lateral canal in the interest of navigation and that the river diversion work connected with such civic development be under the supervision of the Chief of Engineers in order to insure that the interests of interstate and foreign commerce be properly protected; and further provided that local interests hold and save the United States free from any claims for damages that might be incurred due to the construction, maintenance, or operation of such civic development or any part thereof (H. Doc. No. 231, 76th Cong., 1st sess.).

Terminal facilities.—The water terminal and transfer facilities of the district are fully described as of December 31, 1918, in House Document No. 652, Sixty-sixth Congress, second session, pages 1211-1239. Additional data for water terminal and transportation facilities are also contained in Transportation Series No. 2, 1929, Transportation in the Mississippi and Ohio Valleys, and as of 1941, in volume 1 of the four-volume report of the Board of Engineers for Rivers and Harbors, entitled "Survey of Terminals and Landings on the Inland Waterways of the United States."

Operations and results during 'fiscal year.—River stages were favorable to construction work, which was carried on extensively by contract and hired labor with Government plant during the fall of 1942; river conditions were unfavorable during the spring of 1943 and work was carried on only intermittently. A stage of 38.90 feet was recorded on the St. Louis (Market Street) gage on May 24. Regulating works were maintained and project dimensions of channels were secured by dredging. The district's standard specifications for construction work were used. Location, quantities, and costs of open river regulating works follow:

Class of work and locality	Miles above	Dikes (hurdles)				
- A - A - A - A - A - A - A - A - A - A	of Ohio River	Number	Linear feet	Cost		
New work by contract:		-	<u> </u>	-		
Missouri Sister Island-Thompson Towhead-Brooks		1				
Price Townhard Const. T. 1	- 16	7				
Price Towhead-Goose Island	32	1 7	2, 795			
Townstate William Co	1 55	3	3, 205			
Savanty Riv. T thanks	. RK	1 2	1, 230	60, 271, 7		
Establishment Island-Fish Bend-Fort Chartres.	. 98	2	1,600 3,335	77, 425. 7		
Dend-Fort Chartres	132	10	2, 635	134, 152, 9		
Total			a, 000	113, 673. 5		
** * * * * * * * * * * * * * * * * * * *		33	14, 800	609, 161, 4		
New work by United States plant and hired labor: Cairo protection Destroyth Band		=====				
		2	1, 295	38, 502. 3		
		1 1	315	7, 620, 7		
Graysboro * Giboney Island	28	1	210	8, 396, 1		
		1	445	12, 639, 1		
Wilkinson Kaskaskia Island	· 49	2	820	30, 781, 9		
		4	1, 025	36, 863, 4		
Valico Island Cornice Island	114 149	1	175	. 11, 248, 5		
Cornice Island	150	1	170	5, 625. 30		
	100	3	580	14, 922. 47		
		16	5, 035	164, 600, 21		
sintenance by United States plant and hired labor						
The state of the s			23, 365	172,090.44		

Pile and crib dikes.
Solid dikes.
Includes 140 linear feet of solid dikes.
Includes cost of screening 14,915 linear feet of dikes with mattress lumber.

Class of work and locality	Miles	Bank protection (revetments)										
	mouth of Ohio River	Number	nhor feet leet) bank pr		Toe piles bank pro- tection	*Cost						
			tection	Mattress Paving		linear feet	Cost					
New work by contract: Cairo protection Price Landing-Goose Island	1 28	1	1,000	1, 285	324		\$37, 277.					
Cape Girardeau Wilkinson Ste. Genevieve, III Total	49 91 126	1 1 1	2, 055 510 750	2, 039 510 760	478 232 444		2, 190. 50, 935. 22, 037. 30, 710.					
		4 1	4,315	4, 594	1, 478		143, 152.					
ew work by United States plant and hired labor: Cliboney Island Willard	50 66	1	475 525	333 525	157 200		18, 946. ( 16, 311.					
		2	1,000	858	357		35, 258. 3					
aintenance by United States plant and hired abor:			5, 142	1, 249	2, 204	1, 415	121, 246, 8					

New work.—Sixteen dikes, totaling 5,035 feet in length, were built by hired labor with Government plant, at a cost of \$164,600.21. Two revetments, totaling 1,000 feet in length, consisting of 858 squares of mattress and 357 squares of paving were built by hired labor with Government plant, at a cost of \$35,258.32. A total of 271,349 cubic yards of material was handled by a United States hydraulic dredge in preparing one locality for new regulating works at a cost of \$27,673.61,

and 6.08 acres of land in connection with regulating works was purchased at a cost of \$684. Thirty-three dikes, totaling 14,800 feet in length, were built under contract at a cost of \$609,161.48. Four revetments, totaling 4,315 feet in length, consisting of 4,594 squares of mattress and 1,478 squares of paving, were built under contract at a cost of \$143,152.64. In addition to completed work there was under construction, by contract, one dike to total about 165 linear feet and one revetment totaling about 1,240 linear feet, and by hired labor, one revetment to total about 700 feet. The total cost of new work was

\$980,530.26 from regular funds.

Maintenance.-Dikes and revetments were repaired at a cost of \$293,337.24. There were 9,074 cubic yards of rock removed at Beaver Dam, mile 38.4, at a cost of \$16,071.66. The required 9-foot channel was maintained, except for the short periods needed to move a dredge to the shoal, by 3 United States hydraulic dredges. During the year 25 shoals developed of which 23 were dredged once, and I was dredged twice. There were 2,406,540 cubic yards of sand and gravel removed by these dredges from the channel through 25 bars; 305,597 cubic yards of material were removed in outside-the-channel dredg-The channels dredged had a combined length of 23 miles, an average width of 310 feet, and an average gain in depth of 5.4 feet. The total cost of maintenance dredging was \$240,926.71.

Hydrographic surveys were made covering 110 miles of river, costing \$52,684.01. Other miscellaneous costs were: Snagging, \$8,730.02; aids to navigation, \$25,380.06; cooperative stream gaging, \$18,232.90; and gages, \$9,947.05; and safeguarding structures, \$38,002.27, all charged to maintenance. The total cost of all maintenance was \$698,-311.92. The costs during the year were \$980,530.26, from regular funds for new work, and \$698,311.92 for maintenance; however, \$24,811.95 representing the cost of flood relief operations during 1942 fiscal year were transferred in the 1943 fiscal year to the allotment "Emergency repairs and rescue work along the upper Mississippi River, St. Louis District" leaving a net cost for maintenance of \$673,499.97; the total net costs were \$1,654,030.23. The expenditures were \$1,982,642.26 from regular funds.

Condition at end of fiscal year.—Open river regulating works are about 84 percent completed. The quantities required to complete the project are estimated at 75 dikes, 60,000 linear feet; and 40 revetments, 120,000 linear feet. Dikes and revetments are now in good repair and the channel has been greatly improved by the work that has been done. Dredging is required at low stages to remove temporary shoals

and maintain the required channel depths.

In recent years, the project dimensions of channels have generally been maintained throughout the navigation season. The navigation season formerly extended from the middle of February to the middle of December, the river being generally closed by ice the remainder of the year. However, in recent years navigation has continued throughout the winter, except when the river is actually blocked by heavy running ice or gorges. The river is generally above the 10-foot stage, St. Louis gage (period of record, 81 years) for 5½ months of the year, latter part of February to middle of August, during which time project channel depths generally prevail without dredging. mean stage of river for the fiscal year 1942 was 13.60 feet, St. Louis gage. The mean stage of river for the fiscal year 1943 was 14.90 feet.

The following table gives condition of the channel during the fiscal year 1943:

•			Channel affording !—								
Section	Length of sec- tion	9 feet or more		Less than 9 feet		7 feet or less		6 feet or less		Cor trol	
		Length	Pe- riod	Length	Pe- riod	Length	Pe- riod	Length	Pe- riod	dopt	
Ohio River to Commercial Point Commercial Point to Com- merce.	Miles 32.7	Miles 32.7	Days 365	Miles 0	Days 0	Miles 0	Days ()	Miles 0	Days	9	
commerce to Grays Point- lrays Point to Grand Tower lrand Tower to Fort Gage ort Gage to Little Rock	6. 7 6. 6 33. 7 36. 3 9. 5	6. 7 6. 6 33. 7 36. 3 9. 5	365 365 365 365 365	0 0 0	0	0 0 0	0 0 0	- 0 0 0	0 0	9 9	
Ittle Rock to River des Peres iver des Peres to Merchants Bridge	46, 5	46. 5	365	0	. 0	0	0	. ŏ	0 0	0 01	
erchants Bridge to north- ern boundary city of St.	8,0	8.0	365	0	.0	0	0	0	0	12	
orthern boundary to mouth of Missouri River 2.	3.8	3.8	365 365	0	0	0	0	0	0	9)4 12	

Project width is 300 feet from Ohio River to northern boundary of St. Louis and 200 feet from that point to Missouri River, with additional width in bends throughout.

This is known as the "Chain of Rocks Reach."

The costs and expenditures under the existing project to June 30, 1943, have been as follows:

Kind of funds		Costs					
	New work	Maintenance	Total	Expenditures			
Regular Public Works Emergency Relief Total	\$31, 897, 176, 18 3, 462, 154, 46 996, 747, 95	<b>\$25, 424,</b> 152, 58	\$57, 321, 328, 76 3, 462, 154, 46 996, 747, 95	\$57, 804, 087, 9 3, 462, 154, 4 996, 747, 9			
	36, 356, 078, 59	25, 424, 152, 58	61, 780, 231. 17	62, 262, 990. 3			

Proposed operations.—The unexpended balance, including accounts receivable in the amount of \$8,495.58 and \$500,000 advanced to the plant allotment, less revocation of allotment received since June 30, 1943, amounting to \$450,000 will be applied as follows:

Accounts payable June 30, 1943

1943, amounting to \$450,000 will be applied as i	A 1 A 1 A 1 A 1	e June 30,
New work:		<b>\$25, 736. 43</b>
July 1 to August 20, 1042.	1	
Bank protection:	<b>\$9, 1</b> 00, 00	
Cape Girardeau Wilkinson By hired-labor with United State	41, 000, 00 59, 600, 00	, · · · • <b>5</b>
tion of existing job) Toler the plant (comple-		
By contract. July 1, 1948 to Type 20 1044	37, 600. 00	,
Piling dikes: Thompson Towhead  Bank protection:  Cane Girardon Gibbana Towhead	*	:
Cape Girardeau-Giboney Island—Willard Wilkinson Ste. Genevleye, III	44, 000, 00 70, 000, 00	
558155—44—pt. 1, vol. 1——58	100, 000. 00	

· · · · · · · · · · · · · · · · · · ·	U. S. ARWEI, I	943
New_work—Continued.		
By hired labor with United States plant, Jul	l♥ 1.	
70 10 0 0 11 10 10 10 10 10 10 10 10 10 1	·ā —,	
Piling dikes:		
Cairo protection	\$18,000.00	
TIOISCIAII, EASI	49 000 00	
Ronk protection	34, 000, 00,	
Price Landing Ste. Genevieve Missouri	00 000	
Ste. Genevieve, Missouri	22, 000, 00	
Maintenance:		#0.4P 000 00
Maintenance:		\$647, 200, 00
By hired labor with United States plant, July	1.	
20x0, to sune 30, 1944;		
Dikes and bank protection	\$524, 000, 00	
* TOJCCE CHRISTIPE HEADING	<b>200 000 00</b>	
SnaggingRock removal at Beaver Dam	<b>73, 000, 00</b>	
Surveye reserver Dam	34, 000, 00	
Cooperative stream gauging	13, 000, 60	
Total maintenance		
		l, 364, 000, 00
Total for all work Unallocated balance	١ ،	2 000 000 40
Unallocated balance		4, U30, 938, 43
		28, 428. 60
	2	2, 066, 366. 03
The sum of \$2,300,000 can be profitably exvear 1945, as follows:		, 000, 200, 03
year 1945, as follows:	spenaea auring	g the fiscal
y and house, as lottons.		
**- · · · · · ·		
New work:		
By contract, July 1, 1944, to June 30, 1045.	,	·
By contract, July 1, 1944, to June 30, 1945:	<b>\$200, 000</b>	÷
By contract, July 1, 1944, to June 30, 1945:  Dikes  Bank protection	\$200, 000 500, 000	
By contract, July 1, 1944, to June 30, 1945:  Dikes  Bank protection  By hired labor:	500, 000	
By contract, July 1, 1944, to June 30, 1945:  Dikes Bank protection  By hired labor:  Dikes	500, 000	
By contract, July 1, 1944, to June 30, 1945:  Dikes  Bank protection  By hired labor:	500, 000	
By contract, July 1, 1944, to June 30, 1945:  Dikes  Bank protection  By hired labor:  Dikes  Bank protection	500, 000 150, 000 150, 000	
By contract, July 1, 1944, to June 30, 1945:  Dikes  Bank protection  By hired labor:  Dikes  Bank protection  Total for new work  Maintenance:	500, 000 150, 000 150, 000	
By contract, July 1, 1944, to June 30, 1945:  Dikes  Bank protection  By hired labor:  Dikes  Bank protection  Total for new work  Maintenance:  By hired labor with United States plant:	500, 000 150, 000 150, 000	
By contract, July 1, 1944, to June 30, 1945:  Dikes  Bank protection  By hired labor:  Dikes  Bank protection  Total for new work  Maintenance:  By hired labor with United States plant:  Dikes and bank protection	500, 000 150, 000 150, 000	
By contract, July 1, 1944, to June 30, 1945:  Dikes  Bank protection  By hired labor:  Dikes  Bank protection  Total for new work  Maintenance:  By hired labor with United States plant:  Dikes and bank protection  Protect channel drodeing	500, 000 150, 000 150, 000 580, 000	
By contract, July 1, 1944, to June 30, 1945:  Dikes  Bank protection  By hired labor:  Dikes  Bank protection  Total for new work  Maintenance:  By hired labor with United States plant:  Dikes and bank protection  Project channel dredging  Cooperative stream gauging	500, 000 150, 000 150, 000 580, 000	
By contract, July 1, 1944, to June 30, 1945:  Dikes  Bank protection  By hired labor:  Dikes  Bank protection  Total for new work  Maintenance:  By hired labor with United States plant:  Dikes and bank protection  Project channel dredging  Cooperative stream gauging	500, 000 150, 000 150, 000 580, 000	
By contract, July 1, 1944, to June 30, 1945:  Dikes Bank protection  By hired labor: Dikes Bank protection  Total for new work  Maintenance: By hired labor with United States plant: Dikes and bank protection Project channel dredging Cooperative stream gauging Surveys and studies	500, 000 150, 000 150, 000 580, 000 580, 000 20, 000 120, 000	<b>\$1, 000, 000</b>
By contract, July 1, 1944, to June 30, 1945:  Dikes Bank protection  By hired labor: Dikes Bank protection  Total for new work  Maintenance: By hired labor with United States plant: Dikes and bank protection Project channel dredging Cooperative stream gauging Surveys and studies	500, 000 150, 000 150, 000 580, 000 580, 000 20, 000 120, 000	<b>\$1, 000, 000</b>
By contract, July 1, 1944, to June 30, 1945:  Dikes Bank protection  By hired labor:  Dikes Bank protection  Total for new work_  Maintenance:  By hired labor with United States plant:  Dikes and bank protection_  Project channel dredging_ Cooperative stream gauging_ Surveys and studies  Total maintenance	500, 000 150, 000 150, 000 580, 000 580, 000 20, 000 120, 000	\$1, 000, 000 1, 300, 000
By contract, July 1, 1944, to June 30, 1945:  Dikes Bank protection  By hired labor: Dikes Bank protection  Total for new work  Maintenance: By hired labor with United States plant: Dikes and bank protection Project channel dredging Cooperative stream gauging_ Surveys and studies  Total maintenance  Total for all work	500, 000 150, 000 150, 000 580, 000 580, 000 20, 000 120, 000	\$1,000,000 1,300,000 2,300,000
By contract, July 1, 1944, to June 30, 1945:  Dikes Bank protection  By hired labor: Dikes Bank protection  Total for new work  Maintenance: By hired labor with United States plant: Dikes and bank protection Project channel dredging Cooperative stream gauging_ Surveys and studies  Total maintenance  Total for all work	500, 000 150, 000 150, 000 580, 000 580, 000 20, 000 120, 000	\$1,000,000 1,300,000 2,300,000
By contract, July 1, 1944, to June 30, 1945:  Dikes Bank protection  By hired labor:  Dikes Bank protection  Total for new work  Maintenance:  By hired labor with United States plant:  Dikes and bank protection Project channel dredging Cooperative stream gauging Surveys and studies  Total maintenance  Total for all work  It is expected that, with the proposed expense.	500, 000 150, 000 150, 000 580, 000 580, 000 20, 000 120, 000	\$1,000,000 1,300,000 2,300,000
By contract, July 1, 1944, to June 30, 1945:  Dikes Bank protection  By hired labor: Dikes Bank protection  Total for new work  Maintenance: By hired labor with United States plant: Dikes and bank protection Project channel dredging Cooperative stream gauging_ Surveys and studies  Total maintenance  Total for all work	500, 000 150, 000 150, 000 580, 000 580, 000 20, 000 120, 000	\$1,000,000 1,300,000 2,300,000
By contract, July 1, 1944, to June 30, 1945:  Dikes	500, 000  150, 000  150, 000  580, 000  580, 000  20, 000  120, 000  aditures, the pr	\$1,000,000 1,300,000 2,300,000
By contract, July 1, 1944, to June 30, 1945:  Dikes	500, 000  150, 000  150, 000  580, 000  580, 000  20, 000  120, 000  additures, the pr	\$1,000,000 1,300,000 2,300,000 roject will
By contract, July 1, 1944, to June 30, 1945:  Dikes	500, 000  150, 000  150, 000  580, 000  580, 000  20, 000  120, 000  additures, the pr	\$1,000,000 1,300,000 2,300,000 roject will
By contract, July 1, 1944, to June 30, 1945:  Dikes	500, 000  150, 000  150, 000  150, 000  580, 000  580, 000  20, 000  120, 000  120, 000  120, 000  387,  30,	\$1,000,000 1,300,000 2,300,000 roject will 772,698.25 684,757.41
By contract, July 1, 1944, to June 30, 1945:  Dikes	500, 000  150, 000  150, 000  150, 000  580, 000  580, 000  20, 000  120, 000  120, 000  120, 000  387,  30,	\$1,000,000 1,300,000 2,300,000 roject will 772,698.25 684,757.41
By contract, July 1, 1944, to June 30, 1945:  Dikes	500, 000  150, 000  150, 000  150, 000  580, 000  20, 000  120, 000  120, 000  20, 30, 30, 30, 30, 68,	\$1,000,000 1,300,000 2,300,000 coject will 772,698.25 684,757.41 457,455.66
By contract, July 1, 1944, to June 30, 1945:  Dikes	500, 000  150, 000  150, 000  150, 000  580, 000  580, 000  20, 000  120, 000  120, 000  3	\$1,000,000 1,300,000 2,300,000 2,300,000 coject will 772,698.25 684,757.41 457,455.66 500,000.00
By contract, July 1, 1944, to June 30, 1945:  Dikes	500, 000  150, 000  150, 000  150, 000  580, 000  580, 000  20, 000  120, 000  120, 000  3	\$1,000,000 1,300,000 2,300,000 2,300,000 coject will 772,698.25 684,757.41 457,455.66 500,000,00
By contract, July 1, 1944, to June 30, 1945:  Dikes Bank protection By hired labor:  Dikes Bank protection  Total for new work  Maintenance:  By hired labor with United States plant:  Dikes and bank protection  Project channel dredging Cooperative stream gauging Surveys and studies  Total maintenance  Total for all work  It is expected that, with the proposed expende about 88 percent complete.  Cost and financial summar  Cost of new work to June 30, 1943  Cost of maintenance to June 30, 1943  Total cost of permanent work to June 30, 1943  Net total cost to June 30, 1943  Pits accounts receivable June 30, 1943	500, 000  150, 000  150, 000  150, 000  580, 000  20, 000  120, 000  120, 000  3	\$1,000,000 1,300,000 2,300,000
By contract, July 1, 1944, to June 30, 1945:  Dikes	500, 000  150, 000  150, 000  150, 000  580, 000  20, 000  120, 000  120, 000  3	\$1,000,000 1,300,000 2,300,000

2. MISSISSIPPI RIVER BETWEEN MOUTH OF MISSOURI RIVER AND MINNEAPOLIS, MINN. (ST. LOUIS DISTRICT)

See report, "Mississippi River between the Missouri River and Minneapolis, Minn.," page 934.

- 3. ILLINOIS WATERWAY, ILLINOIS (ST. LOUIS DISTRICT)
  See report, "Illinois Waterway, Illinois," page 1381.
- 4. EXAMINATIONS, SURVEYS, AND CONTINGENCIES (GENERAL)

The cost of the work during the year was \$37,442.14 and the expenditures were \$34,712.40. The balance unexpended, \$24,548.54, plus \$5,000

and Dam is included in report on Illinois Waterway, Ill., contained in the report of the district engineer, Chicago, Ill.

District engineer: Col. Lawrence B. Feagin, Corps of Engineers.

Division engineer: Col. Malcolm Elliott, Corps of Engineers.

#### IMPROVEMENTS

•		PHENIO	
Navigation	Page	Flood control—Continued	
1. Mississippi River between the Ohio and Missouri		12. Columbia drainage and levee	Page
Kivers	910	district No. 3. Illinois	925
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5. Other navigation projects for which no estimates are		districts, Illinois River,	
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ing drainage and levee	- 1	22. Other flood-control projects for which no estimates are	
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### 1. MISSISSIPPI RIVER BETWEEN THE OHIO AND MISSOURI RIVERS

Location.—The Mississippi River rises above Lake Itasca, Minn., and, from that lake, flows in a southerly direction about 2,450 miles and empties into the Gulf of Mexico. The portion included in this report embraces the 195-mile section known as the middle Mississippi, between the tributary Ohio and Missouri Rivers, about 1,081 to 1,276 miles from the Gulf.

Previous projects.—The original project for the improvement of the Mississippi River between the Ohio and Missouri Rivers was recommended by a Board of Engineers in a report, dated April 13; 1872, and concurred in by the Chief of Engineers. For further details see page 1879 of the Annual Report for 1915 and page 1014 of the Annual Report for 1938.

Existing project.—This provides for obtaining and maintaining a minimum channel depth of not less than 9 feet, a minimum width of not less than 300 feet at low water, with additional width in bends

from the mouth of the Chio River (about 1,081 miles from the Gulf) to the northern boundary of the city of St. Louis, 191 miles; thence 200 feet wide, with additional width in bends to the mouth of the Missouri River, 4 miles; all to be obtained by regulating works and dredging: First, by regulating works, for closing sloughs and secondary channels, and narrowing the river; by building new banks where the natural width is excessive and protecting new and old banks from erosion where necessary to secure permanency. Second, by dredging or other temporary expedients to maintain channels of project dimensions.

The estimated cost of new work, revised in 1934, is \$43,000,000, with \$1,300,000 for annual maintenance.

The existing project was authorized by the following river and harbor acts:

Acts	Work authorized	Documents
June 3, 1896	Project for regulating works adopted in 1881. (To obtain a minimum depth of 8 feet.)	Annual Report, 1881, p. 1536.
June 13, 1902 Mar. 2, 1907	Dredging introduced as part of the protect	
Mar. 3, 1905 ! Mar. 2, 1907 !	These acts practically abrogated that part of the project for the middle Mississippi which proposed regulating works.	
June 25, 1910	Regulating works restored to the project and appropriations begun with a view to the completion of the improvement between the Ohio and Missouri Rivers within 12 years at an estimated cost of \$21,000,000, exclusive of amounts previously expended.	H. Doc. No. 50, 61st Cong., 1st sess and H. Doc. No. 168, 58th Cong 2d sess.
/an. 21, 1927	For a depth of 9 feet and width of 300 feet from the Ohio River to the northern boundary of the city of St. Louis, with the estimated cost of maintenance increased to \$900,000 annually.	Rivers and Harbors Committee Doc No. 9, 69th Cong., 2d sess.
uly 3, 1930	Project between the northern boundary of the city of St. Louis and Grafton (mouth of Illinois River) modified to provide for a channel 9 feet deep and generally 200 feet wide with additional width around bends, at an estimated cost of \$1,500,000, with \$125,000 annually for maintenance.	Rivers and Harbors Committee Doc. No. 12, 70th Cong., 1st sess.

Also joint resolution, June 29, 1906.

See House Document No. 669 (76th Cong., 3d sess.) for report of Chief of Engineers dated February 27, 1940, containing a general plan for improvement of the Mississippi River between Coon Rapids Dam and the mouth of the Ohio River for purposes of navigation, power development, the control of floods, and the needs of irrigation.

Recommended modifications of project.—Under date of March 15, 1939, the Chief of Engineers recommended modifications of the existing project to approve a comprehensive plan for development of the Mississippi River at Chain of Rocks so as to provide for construction of a lateral canal at an estimated first cost to the United States of approximately \$10,290,000, with annual maintenance and operation

cost of \$70,000, subject to such modification as the Chief of Engineers may find necessary when the project is undertaken; and to authorize the relocation of the river channel and reclamation of the area in Sawyer Bend for airport, park, recreational, and similar purposes at a cost to local interests of approximately \$17,555,000; provided that any modification of the present river channel required by the civic development be deferred until completion of the lateral canal in the interest of navigation and that the river diversion work connected with such civic development be under the supervision of the Chief of Engineers in order to insure that the interests of interstate and foreign commerce be properly protected; and further provided that local interests hold and save the United States free from any claims for damages that might be incurred due to the construction, maintenance, or operation of such civic development or any part thereof (H. Doc. No. 231, 76th Cong., 1st sess.).

(H. Doc. No. 231, 76th Cong., 1st sess.).

Terminal facilities.—The water terminal and transfer facilities of the district are fully described as of December 31, 1918, in House Document No. 652, Sixty-sixth Congress, second session, pages 1211–1239. Additional data for water terminal and transportation facilities are also contained in Transportation Series No. 2, 1929, Transportation in the Mississippi and Ohio Valleys, and as of 1941, in volume 1 of the four-volume report of the Board of Engineers for Rivers and Harbors, entitled "Survey of Terminals and Landings on

the Inland Waterways of the United States."

Operations and results during fiscal year.—Extensive construction work was carried on throughout the first half of the fiscal year, but during the last half of the year, practically no construction work was done because of high river stages. A stage of 39.1 feet (9.1 feet above flood stage) was recorded on the St. Louis (Market Street) gage on April 30. Regulating works were maintained and project dimensions of channels were secured by dredging. The district's standard specifications for construction work were used. Location, quantities, and costs of open river regulating works follow:

Class of work and locality	Miles above	Dikes (hurdles)				
Crass of work and locality	mouth of Ohio River	Number	Linear feet	Cost		
New work by contract: Missouri Sister Island-Thompson Towhead-Brooks Point Cairo Protection-Thompson Towhead-Schenimann Seventy Six-Liberty Total Maintenance by United States plant and hired labor	18 5–58 99	5 1 6	1, 810 165 1, 975 8, 970	\$33, 387. 32 88, 414. 47 15, 863. 99 137, 665. 78		

<sup>&</sup>lt;sup>1</sup> Includes cost of screening 9,920 linear feet of dikes with mattress lumber.

	Miles		Bank pr	otection (re	vetment)			
Class of work and locality	above mouth of Ohio River	Number	1 1665		feet feet) bank p		Toe piles bank pro- tection	Cost
			protec- tion	Mattress	Paving	linear feet		
New work by contract: Cape Girardeau Cape Girardeau-Giboney	49. 5	1.		,	178		\$20, 195, 7	
Island-Willard Wilkinson Do Stc. Genevieve, Ill	48-67 90. 5 91. 5 125	2 1 1 2	810 2,000 1,260	807 1,800 1,260	295 667 254		38, 259, 8 76, 062, 1 51, 442, 7	
Total		7	2, 035 6, 105	2, 035 5, 902	2,479		93, 613. 9	
New work by United States plant and hired labor: Cape Girardeau Ste. Genevieve, Mo	49. 5 123. 5	1 1	860 1,700	861 1, 020	453		35, 550. 28 35, 233, 11	
Total		2	2, 560	1,881	453		70, 783. 39	
faintenance by United States plant and hired labor			8, 456	1, 164	4, 530	9, 955	243, 701, 11	

New work.—Two revetments, totaling 2,560 feet in length, consisting of 1,881 squares of mattress and 453 squares of paving were built by hired labor with Government plant, at a cost of \$70,783.39. A total of 66,969 cubic yards of material was handled by a United States hydraulic dredge in preparing one locality for new regulating works at a cost of \$10,904.99, and an additional cost of \$230,06 was incurred in connection with the purchase of land for regulating works. Six dikes, totaling 1,975 feet in length, were built under contract at a cost of \$137,665.78. Seven revetments, totaling 6,105 feet in length, consisting of 5,902 squares of mattress and 2,479 squares of paving, were built under contract at a cost of \$279,574.42. In addition to completed work there was under construction, by contract, two dikes to total about 2,380 linear feet. The total cost of new work was \$499,208.64, from regular funds.

Maintenance.—Dikes and revetments were repaired at a cost of \$478,741.15. The required 9-foot channel was maintained, except for the short periods needed to move a dredge to the shoal, by four United States hydraulic dredges. During the year 73 shoals developed, of which 71 were dredged once, and 2 were dredged twice. There were 6,810,051 cubic yards of sand and gravel removed by these dredges from the channel through 73 bars; 32,639 cubic yards of material were removed in outside-the-channel dredging at a cost of \$4,496.62. The channels had a combined length of 26 miles, an average width of 345 feet, and an average gain in depth of 5.4 feet. The total cost of maintenance dredging was \$531,092.86.

Hydrographic surveys were made covering approximately 200 miles of river, costing \$68,372.26. Other miscellaneous costs were: Snagging, \$1.598.03; aids to navigation, \$47,258.23; cooperative stream gaging, \$7,010.97; gages, \$21,684,56; safeguarding structures, \$51,894.91; and removing grounded vessels, \$4,815.39, all charged to maintenance. The total cost of all maintenance was \$1,212,468.36. The expenditures were \$1,215,608.81 from regular funds.

Condition at end of fiscal year.—Open river regulating works are about 86 percent completed. The quantities required to complete the project are estimated at 70 dikes, 58,000 linear feet; and 30 revetments, 110,000 linear feet. Dikes and revetments are now in good repair and the channel has been greatly improved by the work that has been done. Dredging is required at low stages to remove temporary shoals and

maintain the required channel depths.

In recent years, the project dimensions of channels have generally been maintained throughout the navigation season. The navigation season formerly extended from the middle of February to the middle of December, the river being generally closed by ice the remainder of the year. However, in recent years navigation has continued throughout the winter, except when the river is actually blocked by running ice or gorges. The river is generally above the 10-foot stage, St. Louis gage for 6 months of the year, latter part of February to latter part of August, during which time project channel depths generally prevail without dredging. The mean stage of the river for the fiscal year 1943 was 14.90 feet, St. Louis gage. The mean stage of the river for the fiscal year 1944 was 12.13 feet.

The following table gives condition of the channel during the fiscal

year 1944:

		Channel affording 1—								T :
Section .	Length of sec- tion	9 feet or more		Less than 9 feet		7 feet or less		6 feet or less		Con trol
		Length	Peri- od	Length	Peri- od	Length	Peri- od	Length	Peri-	depth
Ohio River to Commercial Point Commercial Point to Com- merce	Miles 32.7	Miles 31. 9	Days 363	Miles 0.8	Days 2	Miles 0	Days 0	Miles 0	Days 0	Feet 8
Commerce to Grays Point Prays Point to Grand Tower Prand Tower to Fort Gage Fort Gage to Little Rock Attle Rock to River des	6. 7 6. 6 33. 7 36. 3 9. 5	5. 5 5. 7 32. 9 35. 9 9. 5	363 363 362 364 365	1, 2 .9 .8 .4	2 2 3 1 0	0000	0	0 0	0 0 0	8 8 8 81
Peres Liver des Peres to Merchants Bridge	46. 5 13. 2	45. 3 11. 2	364 365	1. 2	1	0	o l	0	0	8
ferciants Bridge to northern boundary city of St. Louis	8. 0	8.0	365	0	0	0	0	0	0	11
of Missouri River	3.8	3.8	365	0	0	0	0	0	0	9

<sup>&</sup>lt;sup>1</sup> Project width is 300 feet from Ohio River to northern boundary of St. Louis and 200 feet from that point to Missouri River, with additional width in bends throughout,

<sup>2</sup> This is known as the "Chain of Rocks Reach."

The costs and expenditures under the existing project to June 30, 1944, have been as follows:

Kind of funds	Costs			
	New work	Maintenance	Total	Expenditures
Regular	\$32, 396, 384, 82 3, 462, 154, 46 996, 747, 95	\$26, 636, 620. 94	\$59, 033, 005, 76 3, 462, 154, 46 996, 747, 95	\$59, 019, 696, 72 3, 462, 154, 46 996, 747, 95
Total	36, 855. 287. 23	26, 636, 620. 94	63, 491, 908. 17	63, 478; 599, 13

Proposed operations.—The unexpended balan- fiscal year plus \$2,000,000 allotted since June 20	
fiscal year plus \$2,000,000 allotted since June 30, as follows:	ce at the end of th
as follows:	1944, will be applie
Accounts manual I	
Accounts payable, June 30, 1944New work:	
By contract (completion of the	ф19, 509. (
By contract (completion of existing contract), July 1 to Aug. 25, 1944:	
Piling dikes: Cairo protonting The	
	10 000 ==
	36, 000. 00
~ ming wings,	
Hurricane Field-Thompson Towhead 10	4, 000. 00
TI THE TANK AND THE PROPERTY AND THE TREE PR	55, 000. 00
	5, 000. 00
-ami protection:	-,
Price Landing-Goose Island Seventy Six 100	0, 000. 00
By hired labor with United States plant, July 1,	0, 000. 00
Piling dikes:	
Devils Island	1 000 00
OMORICA TURNINI	4, 000, 00 6, 000, 00
	0, 000, 00
Boston Bar	3, 000. 00
Bank protection	0, 000. 00
Bank protection: Giboney Island 33	,
Saboney Island	3, 000. 00
Maintenance: Total for new work	
Maintenance:	<b> 1, 086, 000, 00</b>
By hired labor with United States plant, July 1,	
1944, to June 30, 1945:	
Dikes and bank protection \$404 Project channel dredging	. 000. 00
Project channel dredging 5404, Snagging 567,	, 000, 00
Snagging 567, Rock removal at Reaver Dom 73,	, 000. 00
Surveys, gages, and studies 34,	, 000, 00
Surveys, gages, and studies 99, Aids to navigation 50, Cooperative stream gaging 15,	, 000, 00
Cooperative stream gaging	, 000, 00
10,	000.00
Total maintenance Unallocated balance	1 242 000 00
Unallocated balance	952. 60
Total for all work	002.00
Total for all work.	2, 342, 261. 64
The built of philosophy (IR) ha hypothesis armonda	d during the forel
year 1946, as follows:	a daring the lister
New work:	
By contract, July 1, 1945, to June 30, 1946:	
	000.000
~ CIIA DIULEGLAIII	280, 000
By hired labor:	470, 000
DikesBank protection	100 000
Bank protection	100, 000
T-4-1 6	
Total for new work  By hired labor with United States plants	\$1,000,000
By hired labor with United States plant:	φ1, 000, 000
	265. 000
Project channel dredging 5	550, 000
Snagging 5	30, 000
Aids to navigation	
Aids to navigationCooperative stream gaging	50, 000
00	10, 000
Total maintenance	1 000 000
Total for all	1, 000, 000
Total for all work	<b>2, 000, 000</b>
	·· ~, vvv, vvv

## 916 REPORT OF CHIEF OF ENGINEERS, U. S. ARMY, 1944

It is expected that, with the proposed expenditures, the project will be about 91 percent complete.

Cost	and	financial	summary
------	-----	-----------	---------

Clark met and a second	Cost ana				
Cost of new work to Jun Cost of maintenance to J	e 30, 1944 <sub>-</sub> June 30, 19	44		\$38 1 31	, 271, 906. 8 , 897, 225. 7
Minus accounts payable	anent wor	k to June 3	0, 1944	70	, 169, 132, 6
Unexpended balance June	e 30, 1944_			<sup>1</sup> 70	155, 823. 6 342, 261, 6
Total amount app	ropriated to	o June 30,	1944	1 70,	498, 085. 2
Fiscal year ending June 30	1910	1941	1942	1943	1944
Cost of new work	\$696, 655. 23 1, 092, 307. 96	\$900, 722. 54 725, 050. 95	\$558, 732, 47 891, 127, 93	\$990, 530. 26 673, 490. 97	\$499, 208. (
Total cost	1, 778, 963. 19	1, 715, 773. 49	1, 449, 860, 40	1, 654, 030, 23	
Total expended	2, 017, 684. 98	1, 568, 360. 93	1, 594, 454. 40		7.22,077.6
Allotted	2, 009, 040. 00	1, 750, 000. 00	2, 034, 400. 00	1, 982, 642, 26	1, 215, 608, 8
			.,, 100, 00	1, 574, 000. 00	<b>-450,000.0</b>
a to account of	TOYOUAGION	of Huotmor	1t		150, 000. 00
Balance unexpended July Deductions on account of  Net amount to be a Gross amount expended Less reimbursements collections.	ecounted for	or	\$1, 734, 62 519, 01	0. 41 1. 60	450, 000. 00 557, 870. 45
Net amount to be a Gross amount expended Less reimbursements collect  Relence uperpended	ecounted for	or	\$1, 734, 62 519, 01	0. 41 1. 60 1, 2	450, 000. 00 557, 870. 45 215, 608. 81
Net amount to be a Gross amount expended Less reimbursements collec  Balance unexpended Outstanding liabilities June Amount covered by uncom	etedl June 30, 1 9 30, 1944_pleted conf	or	\$1, 734, 62 519, 01 \$6, 12 121, 31	0. 41 1. 60 1, 5 7. 72 0. 17	450, 000. 00 557, 870. 45 815, 608. 81 42, 261. 64
Net amount to be a Gross amount expended Less reimbursements collec  Balance unexpended Outstanding liabilities June Amount covered by uncom  Balance available June Amount allotted since June	decounted for the state of the	or another	\$1, 734, 62; 519, 01 \$6, 12; 121, 316	7. 72 0. 17 1. 60 1. 2 2. 0. 17 1. 2 2. 0. 17	215, 608. 81 215, 608. 81 227, 446. 89
Net amount to be a Gross amount expended Less reimbursements collect  Balance unexpended Outstanding liabilities June Amount covered by uncom  Balance available June Amount allotted since June Amount available fo	decounted for the state of the	or another or	\$1, 734, 62 519, 01 \$6, 127 121, 316	7. 72 7. 72 9. 17 1 2, 0	215, 608. 81 42, 261. 64 27, 446. 89 14, 814. 75 00, 000. 00
Net amount to be a Gross amount expended Less reimbursements collect  Balance unexpended  Outstanding liabilities June Amount covered by uncom  Balance available June  Amount allotted since June  Amount available for	decounted for the state of the	or another or 1944	\$1, 734, 62 519, 01 \$6, 12 121, 31	7. 72 7. 72 7. 72 9. 17 1 2, 0 2, 2	150, 000. 00 157, 870. 45 15, 608. 81 142, 261. 64 27, 446. 89 14, 814. 75 100, 000. 00 14, 814. 75
Net amount to be a Gross amount expended Less reimbursements collect  Balance unexpended Outstanding liabilities June Amount covered by uncom  Balance available June Amount allotted since June Amount available for confident control of existing project 2  mount that can be profit.	June 30, 1944 pleted cond ine 30, 1944 pleted cond ine 30, 1944 r fiscal year ed to be appart	or another or	\$1, 734, 62, 519, 01  \$6, 12, 121, 319  for complete all year end	7. 72 9. 17 1. 60 1, 2 2. 17 1 2. 2, 0 3. 17 2, 2 3. 17 2, 2 3. 17 5, 00	215, 608. 81 42, 261. 64 27, 446. 89 14, 814. 75 00, 000. 00
Net amount to be a Gross amount expended Less reimbursements collect  Balance unexpended Outstanding liabilities June Amount covered by uncom  Balance available June Amount allotted since June Amount available for confident control of existing project 2  mount that can be profit.	June 30, 1944 pleted cond ine 30, 1944 pleted cond ine 30, 1944 r fiscal year ed to be appart	or another or	\$1, 734, 62, 519, 01  \$6, 12, 121, 319  for complete all year end	7. 72 7. 72 7. 72 7. 72 7. 72 7. 72 7. 72 7. 72 7. 72 9. 17 2, 0 2, 2 2, 2 3 ing	14, 814. 75 00, 000. 00 14, 814. 75 00, 000. 00
Net amount to be a Gross amount expended Less reimbursements collect Balance unexpended Dutstanding liabilities June Amount covered by uncom  Balance available June Management (estimated) require of existing project 2  mount that can be profit.	June 30, 1944.  and to be appeared to be appeared.	or another or	\$1, 734, 62; 519, 01  \$6, 12; 121, 319  for complete al year end	7. 72 9. 17 1. 60 1, 2 7. 72 9. 17 1 2, 2 2, 2 3 ion 5, 00 ing	350, 000. 00 557, 870. 45 315, 608. 81 342, 261. 64 27, 446. 89 14, 814. 75 00, 000. 00 14, 814. 75

<sup>&</sup>lt;sup>1</sup> Includes \$5,260,604.83 from permanent indefinite appropriation covering snagging operations of which \$280,572.72 perfained to Vicksburg and Memphis districts.

<sup>2</sup> Exclusive of available funds.

# 2. MISSISSIPPI RIVER BETWEEN MOUTH OF MISSOURI RIVER AND MINNEAPOLIS, MINN. (ST. LOUIS DISTRICT)

See report, "Mississippi River between the Missouri River and Minneapolis, Minn.," page 939.

### 1. MISSISSIPPI RIVER BETWEEN THE OHIO AND MISSOURI RIVERS

Location.—The Mississippi River rises in Lake Itasca, Minn., and, from that lake, flows in a southerly direction about 2,450 miles and empties into the Gulf of Mexico. The portion included in this report embraces the 195-mile section known as the middle Mississippi, between the tributary Ohio and Missouri Rivers, about 1,081 to 1,276 miles from the Gulf.

Previous projects.—The original project for the improvement of the Mississippi River between the Ohio and Missouri Rivers was recommended by a Board of Engineers in a report, dated April 13, 1872, and concurred in by the Chief of Engineers. For further details see page 1879 of the Annual Report for 1915 and page 1014

of the Annual Report for 1938.

Existing project.—This provides for obtaining and maintaining a minimum channel depth of not less than 9 feet, a minimum width of not less than 300 feet at low water, with additional width in bends from the mouth of the Ohio River (about 1,081 miles from the Gulf) to the northern boundary of the city of St. Louis, 191 miles; thence 200 feet wide, with additional width in bends to the mouth of the Missouri River, 4 miles; to be obtained: First, by regulating works, for closing sloughs and secondary channels, and narrowing the river; by building new banks where the natural width is excessive and protecting new and old banks from erosion where necessary to secure permanency; Second, by dredging or other temporary expedients to maintain channels of project dimensions; Third, by construction of works authorized for the Chain of Rocks reach in the River and Harbor Act of March 2, 1945, which approved a comprchensive plan for development of the Mississippi River at Chain of Rocks so as to provide for construction of a lateral canal at an estimated first cost to the United States of approximately \$10,290,000, with annual maintenance and operation cost of \$70,000, subject to such modification as the Chief of Engineers may find necessary when the project is undertaken; and to authorize the relocation of the river channel and reclamation of the area in Sawyer Bend for airport, park, recreational, and similar purposes at a cost to local interests of approximately \$17,555,000; provided that any modification of the present river channel required by the civic development be deferred until completion of the lateral canal in the interest of navigation and that the river diversion work connected with such civic development be under the supervision of the Chief of Engineers in order to insure that the interests of interstate and foreign commerce be properly protected; and further provided that local interests hold and save the United States free from any claims for damages that might be incurred due to the construction, maintenance, or operation of such civic development or any part thereof (H. Doc. No. 231, 76th Cong., 1st sess.).

The estimated cost of new work, revised in 1945, is \$53,266,000,

with \$1,370,000 for annual maintenance.

The existing project was authorized by the following river and harbor acts:

Acts	Work authorized	Documents
June 3, 1896	Project for regulating works adopted in 1881.  (To obtain a minimum depth of 8 feet.)	Annual Report, 1841, p. 1636.
June 13, 1902 Mar. 2, 1907	Dredging introduced as part of the project	•
Mar. 3, 1905 i Mar. 2, 1907 i	These acts practically abrogated that part of the project for the middle Mississippi which proposed regulating works.	
June 25, 1910	Regulating works.  Regulating works restored to the project and appropriations begun with a view to the completion of the improvement between the Ohio and Missouri Rivers. within 12 years at an estimated cost of \$21,000,000, exclusive of amounts previously expended.	H. Doc. No. 50, 61st Cong., 4st sess and H. Doc. No. 168, 58th Cong. 2d sess.
an. 21, 1927	For a depth of 9 feet and width of 300 feet from the Ohio River to the northern boundary of the city of St. Louis, with the estimated cost of maintenance increased to \$900,000 annually.	Rivers and Harbors Committee Doc No. 9, 69th Cong., 2d sess.
uly 3, 1930	city of St. Louis and Grafton (mouth of Illinois River) modified to provide for a channel 9 feet deep and generally 200 feet wide with additional width around bends, at an estimated cost of \$1,500,000, with \$125,000 annually for maintenance.	Rivers and Harbors Committee Doc. No. 12, 70th Cong., 1st sess.
far. 2, 1945	Modified to provide for construction of a lateral canal with lock at Chain of Rocks, at an estimated first cost to the United States of about \$10,290,000, with \$70,000 annually for maintenance and operation.	H. Duc. No. 231, 76th Cong., 1st sess

<sup>&</sup>lt;sup>1</sup> Also joint resolution, June 29, 1906.

See House Document No. 669 (76th Cong., 3d sess.) for report of Chief of Engineers dated February 27, 1940, containing a general plan for improvement of the Mississippi River between Coon Rapids Dam and the mouth of the Ohio River for purposes of navigation, power development, the control of floods, and the needs of irrigation.

Terminal facilities.—The water terminal and transfer facilities of the district are fully described as of December 31, 1918, in House Document No. 652, Sixty-sixth Congress, second session, pages 1211–1239. Additional data for water terminal and transportation facilities are also contained in Transportation Series No. 2, 1929, Transportation in the Mississippi and Ohio Valleys, and as of 1941, in volume 1 of the four-volume report of the Board of Engineers for Rivers and Harbors, entitled "Survey of Terminals and Landings on the Inland Waterways of the United States."

Operations and results during fiscal year.—Construction work by contract and hired labor was curtailed due to high river stages. Stages in excess of 32 feet were recorded during March, April, May, and June, and for the third consecutive year a stage in excess of 30 feet (flood stage) was recorded on the St. Louis (Market Street) gage. Regulating works were maintained and project dimensions of channels were secured by dredging. The district's

standard specifications for construction work were used. Location, quantities and costs of open river regulating works follow:

Oleman I	Miles above	Dikes (hurdles)			
Class of work and locality	mouth of Ohio River	Number	Linear feet	Cost	
New work by contract; Cairo Protection-Thompson Towhead-Schenimann. Hurricane Field-Thompson Towhead. Kaskaskia Island-Ste, Genevieve, Iii. Fish Bend-Pulitight.	17. 4- 17. 8 8. 3- 17. 5 112. 7-124. 5 158. 9-160. 6	2 5 6	2, 380 555 1, 410 3, 490	\$77, 119, 05 65, 372, 03 120, 553, 91 208, 581, 58	
Total		19	7, 835	471, 626, 57	
New work by United States plant and hired labor: Devils Island Cheeley Island	58. G 169. G	3 3	1, 140 380	62, 122. 10 18, 005. 43	
Total		6	1, 520	70, 127. 83	
Maintenance by United States plant and hire Flabor.	***********		6, 400	1 202, 342. 58	

<sup>2</sup> Includes cost of screening 2,640 linear feet of dikes with mattress lumber.

		1					
Clare of week and the Mr.	Miles above mouth Num-		Linear feet bank	Squares (100 square feet)		Toe piles	
Class of work and locality	of Ohio River	ber	protec- tion	Mat- tress	Paving	protec- tion	Cost
New work by contract: Price Landing-Goose Island Seventy Six	27 9 94. 7	1	1,015	1, 015 1, 110	113 471		\$14, 978. 16 61, 909. 13
Total	••••		2, 155	2, 165	584		65, 987, 29
New work by United States plant and hired labor: Seventy Six	95	rarenzand I	rentrum ra	(1)	*********	********	153. 25
Total							153, 25
Maintenance by United States plant and hired labor		= = = = = = = = = = = = = = = = = =	7, 678	1, 303	3, 273	3, 970	198, 423. 01

<sup>1</sup> Work consisted of grading only.

New work.—Six dikes, totaling 1,520 feet in length, were built by hired labor with Government plant, at a cost of \$70,127.53. Work for one revetment, consisting only of grading 1,200 cubic yards of material by hired labor with Government plant, was accomplished at a cost of \$153.25, and 241,797 cubic yards of material were handled by two United States hydraulic dredges in preparing one locality for new regulating works at a cost of \$35,743.25. Nineteen dikes, totaling 7,835 feet in length, were built under contract at a cost of \$471,626.57. Two revetments, totaling 2,155 feet in length, consisting of 2,155 squares of mattress and 584 squares of paving, were built under contract at a cost of \$65,987.28. In addition to complete work there was under construction, by contract, 1 revetment to total about 1,160 linear feet and 10 dikes, totaling about 5,645 linear feet. The total cost of new work was \$643,637.88, from regular funds.

Maintenance.—Dikes and revetments were repaired at a cost of \$400,806.49. The required 9-foot channel was maintained, except for the short periods needed to move a dredge to the shoal, by three United States hydraulic dredges. During the year 46 shoals developed, of which 43 were dredged once, and 2 were dredged twice. There were 4,824,627 cubic yards of sand and gravel removed by these dredges from the channel through 46 bars; 217,173 cubic yards of material were removed in outside-the-channel dredging at a cost of \$30,840.27. The channels had a combined length of 19 miles, an average width of 310 feet, and an average gain in depth of 5.9 feet. The total cost of maintenance dredging was \$440,223.35.

Hydrographic surveys were made covering approximately 105 miles of river, costing \$36,943.85. Other miscellaneous costs were: Snagging, \$15,837.42; aids to navigation, \$21,836.16; gages, \$15,565.61; cooperative stream gaging, \$6,981.87; safeguarding structures, \$39,394.15; and releasing grounded vessels, \$598.64, all charged to maintenance. The total cost of all maintenance was \$978,187.54. The expenditures were \$1,749,137.27 from regular funds.

Condition at end of fiscal year.—Work under this project is about 70 percent complete. The quantities required to complete the project are estimated at 45 dikes, 49,000 linear feet; 28 revetments, 108,000 linear feet, and the canal, lock, and levees at Chain of Rocks as recommended in House Document No. 231. Dikes and revetments are now in good repair and the channel has been greatly improved by the work that has been done. Dredging is required at low stages to remove temporary shoals and maintain the required channel depths.

In recent years, the project dimensions of channels have generally been maintained throughout the navigation season. The navigation season formerly extended from the middle of February to the middle of December, the river being generally closed by ice the remainder of the year. However, in recent years navigation has continued throughout the winter, except when the river is actually blocked by running ice or gorges. The river is generally above the 10-foot stage, St. Louis gage, for 6 months of the year, latter part of February to latter part of August, during which time project channel depths generally prevail without dredging. The mean stage of the river for the fiscal year 1944 was 12.13 feet, St. Louis gage. The mean stage of the river for the fiscal year 1945 was 13.25 feet.

The following table gives condition of the channel during the fiscal year 1945:

	Channel affording :									
Section	Length of sec-	of sec-		Less than 9 feet		7 feet or less		6 feet or less		Con-
	tion	Length	Period	Length	Period	Length	Period	Length	Period	trollin depth
Ohio River to Commercial	Miles	Miller	Days	Milea	Days	Miles	Days	Miles	Days	Feet
Commercial Point to Com-	32.7	32. 7	365	0	0	0	0	0	0	10.
ommerce to Grays Point	6. 7 6. 6	6. 7 6. 6	365 365	0	0	0	ņ	0	0	9.
TOUGHTOWATTO FORT (luga )	33. 7 30. 3	33. 7 36. 3	305 305	ö	ő	ō	0	0	0	10. 9.
ort Gage to Little Rock	9. 5	9. 5	365	ő	ŏ	0	0	0	0	9. 10.
Peres.	46.8	46. 5	365	0	0	o J	o l	0	0	9.
chants Bridge	11. 2	11.2	365	n	0	0	0	0	0	13.
orthern boundary city of	8.0	7.9	364	0.1	1	0	0	0	0	8. (
souri River	3. 8	3.8	365	0	0	0	n l		0	10. 8

<sup>&</sup>lt;sup>1</sup> Project width is 300 feet from Ohio River to northern boundary of St. Louis and 200 feet from that point to Missouri River, with additional width in bends throughout.

\* This is known as the "Chain of Rocks Reach."

The costs and expenditures under the existing project to June 30, 1945, have been as follows:

Kind of funds		Costs		
	New work	Maintenance	Total	Expenditures
Regular Public Works Emergency Relief	990, 747, 95	*******	\$50, 654, 831, 18 3, 102, 154, 46 996, 747, 95	\$60, 768, 833. 99 3, 462, 154. 46 996, 747. 95
	37, 408, 925, 11	27, 614, 808, 48	05, 113, 733, 59	65, 227, 736. 40

Proposed operations.—The unexpended balance at the end of the fiscal year, plus additional amounts to be made available, will be applied as follows:

applied as follows:	made available, will be
Accounts payable, June 30, 1945New_work:	<b>\$35, 997. 19</b>
By contract (completion of existing contracts), Aug. 1, 1945, to June 30, 1946: Piling dikes:	
Hurricane Field-Thompson Tow-	***
Kaskaskia Island-Ste. Genevieve	\$58, 000. 00
111,	84, 300, 00
Fish Bend-PulltightBank protection:	238, 000. 00
Price Landing-Goose Island By contract, July 1, 1945, to June 30, 1946: Piling dikes:	85, 500. 00
Schenimann	140, 000. 00
	117, 000, 00
Bank protection:	294, 000. 00
Goose Island	73, 700. 00
Cape Girardeau-Wilkinson	86, 000, 00
Danby Landing	71, 500. 00

By hired labor with United States plant,		
Filing dikes:		
Dogtooth Bend	50, 000. 00	
Seventy SixSolid dikes:	30, 000, 00	
Boston Bar	00 000 00	
Googe Island	33, 000, 00 50, 000, 00	
Dalik Driterrian •		
Dogtooth Bend	33, 000 (:0	
Giboney Island Advance planning, Chain of Rocks (River	33, 000. 00	
MIN MALDUL MEL STITTOMAN MAR O 1012		
equivilect the moningation of project Mil-		
migaiphi Miver Derween the Chic and Mi-		
DUULI RIVERS AS Set forth in LF The Mr.		
231, 76th Cong.)	365, 000. 00	
Total for new work	-	<b>.</b>
		1, 842, 000. 00
By hired labor with United States plant,		
vuly 1, 1940, to Jima XII 1978,		
Dikes and bank protection	437, 830. 00	
Troject channel areasing	534, 000, 00	
Safeguarding structures Snagging	49, 000, 00	
Surveys, gages and studies	31,000.00	
Surveys, gages and studies Aids to navigation	48 000 00	
Cooperative stream gaging	15, 000, 00	
Total maintenanceUnallocated balance		1, 199, 830, 00
		297. 18
and the second s		
Total for all work		3, 078, 124, 37
Total for all work		3, 078, 124. 37
The sum of \$4,800,000 can be profitable	y expended	3, 078, 124. 37 during the
Total for all work The sum of \$4,800,000 can be profitable fiscal year 1947, as follows:	y expended	3, 078, 124. 37 during the
The sum of \$4,800,000 can be profitable fiscal year 1947, as follows:  New work:	y expended	33, 078, 124. 37 during the
The sum of \$4,800,000 can be profitable fiscal year 1947, as follows:  New work:  By contract, July 1, 1946, to June 30, 1947.	y expended	33, 078, 124. 37 during the
The sum of \$4,800,000 can be profitable fiscal year 1947, as follows:  New work:  By contract, July 1, 1946, to June 30, 1947:  Chain of Rocks project:	y expended	during the
The sum of \$4,800,000 can be profitable fiscal year 1947, as follows:  New work:  By contract, July 1, 1946, to June 30, 1947:  Chain of Rocks project:  Construction of bridge	y expended	during the
The sum of \$4,800,000 can be profitable fiscal year 1947, as follows:  New work:  By contract, July 1, 1946, to June 30, 1947:  Chain of Rocks project:  Construction of bridge  Relocation of utilities	y expended \$680,000	during the
The sum of \$4,800,000 can be profitable fiscal year 1947, as follows:  New work:  By contract, July 1, 1946, to June 30, 1947:  Chain of Rocks project:  Construction of bridge  Relocation of utilities  Commencement of channel excavation  Conimencement of lock construction	y expended \$680,000 240,000 n 970,000	during the
The sum of \$4,800,000 can be profitable fiscal year 1947, as follows:  New work:  By contract, July 1, 1946, to June 30, 1947:  Chain of Rocks project:  Construction of bridge  Relocation of utilities  Commencement of channel excavation Commencement of lock construction Dikes	\$680,000 \$40,000 970,000 100,000	during the
The sum of \$4,800,000 can be profitable fiscal year 1947, as follows:  New work:  By contract, July 1, 1946, to June 30, 1947:  Chain of Rocks project:  Construction of bridge  Relocation of utilities  Commencement of channel excavation Commencement of lock construction Dikes  Bank protection	\$680,000 \$680,000 n = 970,000 100,000	during the
The sum of \$4,800,000 can be profitable fiscal year 1947, as follows:  New work: By contract, July 1, 1946, to June 30, 1947: Chain of Rocks project: Construction of bridge Relocation of utilities Commencement of channel excavation Conimencement of lock construction Dikes Bank protection By hired labor:	\$680,000 \$40,000 970,000 100,000	during the
The sum of \$4,800,000 can be profitable fiscal year 1947, as follows:  New work:  By contract, July 1, 1946, to June 30, 1947:  Chain of Rocks project:  Construction of bridge  Relocation of utilities  Commencement of channel excavation  Conimencement of lock construction  Dikes  Bank protection  By hired labor:  Chain of Rocks project:	\$680,000 \$680,000 240,000 970,000 100,000 448,000 350,000	during the
The sum of \$4,800,000 can be profitable fiscal year 1947, as follows:  New work:  By contract, July 1, 1946, to June 30, 1947:  Chain of Rocks project:  Construction of bridge  Relocation of utilities  Commencement of channel excavation  Commencement of lock construction  Dikes  Bank protection  By hired labor:  Chain of Rocks project:  Land acquisition  Dikes	\$680,000 240,000 1 970,000 100,000 448,000 350,000	during the
The sum of \$4,800,000 can be profitable fiscal year 1947, as follows:  New work:  By contract, July 1, 1946, to June 30, 1947:  Chain of Rocks project:  Construction of bridge  Relocation of utilities  Commencement of channel excavation  Commencement of lock construction  Dikes  Bank protection  By hired labor:  Chain of Rocks project:  Land acquisition  Dikes	\$680,000 \$680,000 240,000 970,000 100,000 448,000 350,000	during the
The sum of \$4,800,000 can be profitable fiscal year 1947, as follows:  New work:  By contract, July 1, 1946, to June 30, 1947:  Chain of Rocks project:  Construction of bridge  Relocation of utilities  Commencement of channel excavation  Conimencement of lock construction  Dikes  Bank protection  By hired labor:  Chain of Rocks project:  Land acquisition  Dikes  Bank protection  Bank protection	\$680,000 \$680,000 240,000 100,000 448,000 350,000 510,000 90,000 912,000	during the
The sum of \$4,800,000 can be profitable fiscal year 1947, as follows:  New work:  By contract, July 1, 1946, to June 30, 1947:  Chain of Rocks project:  Construction of bridge  Relocation of utilities  Commencement of channel excavation  Conimencement of lock construction  Dikes  Bank protection  By hired labor:  Chain of Rocks project:  Land acquisition  Dikes  Bank protection  Total for new work	\$680,000 \$680,000 240,000 100,000 448,000 350,000 510,000 90,000 912,000	during the
The sum of \$4,800,000 can be profitable fiscal year 1947, as follows:  New work:  By contract, July 1, 1946, to June 30, 1947:  Chain of Rocks project:  Construction of bridge  Relocation of utilities  Commencement of channel excavation  Conmencement of lock construction  Dikes  Bank protection  By hired labor:  Chain of Rocks project:  Land acquisition  Dikes  Bank protection  Total for new work  Maintenance:	\$680,000 \$680,000 240,000 100,000 448,000 350,000 510,000 90,000 912,000	during the
The sum of \$4,800,000 can be profitable fiscal year 1947, as follows:  New work:  By contract, July 1, 1946, to June 30, 1947:  Chain of Rocks project:  Construction of bridge  Relocation of utilities  Commencement of lock construction  Dikes  Bank protection  By hired labor:  Chain of Rocks project:  Land acquisition  Dikes  Bank protection  Total for new work  Maintenance:  By hired labor with United States plant:  Dikes and bank protection	\$680,000 240,000 1 970,000 350,000 510,000 90,000 112,000	during the
The sum of \$4,800,000 can be profitable fiscal year 1947, as follows:  New work:  By contract, July 1, 1946, to June 30, 1947:  Chain of Rocks project:  Construction of bridge  Relocation of utilities  Commencement of channel excavation of the construction.  Dikes  Bank protection  By hired labor:  Chain of Rocks project:  Land acquisition  Dikes  Bank protection  Total for new work  Maintenance:  By hired labor with United States plant:  Dikes and bank protection  Project channel dredging	\$680,000 240,000 1 970,000 100,000 448,000 350,000 510,000 90,000 112,000	during the
The sum of \$4,800,000 can be profitable fiscal year 1947, as follows:  New work:  By contract, July 1, 1946, to June 30, 1947:  Chain of Rocks project:  Construction of bridge  Relocation of utilities  Commencement of channel excavation of the construction.  Dikes  Bank protection  By hired labor:  Chain of Rocks project:  Land acquisition  Dikes  Bank protection  Total for new work  Maintenance:  By hired labor with United States plant:  Dikes and bank protection  Project channel dredging	\$680,000 240,000 1 970,000 100,000 448,000 350,000 510,000 90,000 112,000	during the
The sum of \$4,800,000 can be profitable fiscal year 1947, as follows:  New work:  By contract, July 1, 1946, to June 30, 1947:  Chain of Rocks project:  Construction of bridge  Relocation of utilities  Commencement of channel excavation  Conimencement of lock construction  Dikes  Bank protection  By hired labor:  Chain of Rocks project:  Land acquisition  Dikes  Bank protection  Total for new work  Maintenance:  By hired labor with United States plant:  Dikes and bank protection  Project channel dredging  Snagging  Aids to navigation	\$680,000 240,000 100,000 448,000 350,000 510,000 112,000 112,000 550,000 30,000 50,000	during the
The sum of \$4,800,000 can be profitable fiscal year 1947, as follows:  New work:  By contract, July 1, 1946, to June 30, 1947:  Chain of Rocks project:  Construction of bridge  Relocation of utilities  Commencement of channel excavation Commencement of lock construction Dikes  Bank protection  By hired labor:  Chain of Rocks project:  Land acquisition  Dikes  Bank protection  Total for new work  Maintenance:  By hired labor with United States plant:  Dikes and bank protection  Project channel dredging  Snagging  Aids to navigation  Cooperative stream gaging	\$680,000 240,000 100,000 448,000 350,000 510,000 112,000 112,000 550,000 30,000 50,000	during the
The sum of \$4,800,000 can be profitable fiscal year 1947, as follows:  New work:  By contract, July 1, 1946, to June 30, 1947:  Chain of Rocks project:  Construction of bridge  Relocation of utilities  Commencement of channel excavation of the construction of the co	\$680,000 \$680,000 240,000 100,000 448,000 350,000 \$10,000 90,000 112,000 \$565,000 \$50,000 \$0,000 15,000 90,000	during the
The sum of \$4,800,000 can be profitable fiscal year 1947, as follows:  New work:  By contract, July 1, 1946, to June 30, 1947:  Chain of Rocks project:  Construction of bridge  Relocation of utilities  Commencement of channel excavation of the construction of the co	\$680,000 \$680,000 240,000 100,000 448,000 350,000 \$10,000 90,000 112,000 \$565,000 \$50,000 \$0,000 15,000 90,000	during the \$3,500,000
The sum of \$4,800,000 can be profitable fiscal year 1947, as follows:  New work:  By contract, July 1, 1946, to June 30, 1947:  Chain of Rocks project:  Construction of bridge  Relocation of utilities  Commencement of lock construction  Dikes  Bank protection  By hired labor:  Chain of Rocks project:  Land acquisition  Dikes  Bank protection  Total for new work  Maintenance:  By hired labor with United States plant:  Dikes and bank protection  Project channel dredging  Snagging  Aids to navigation  Cooperative stream gaging  Surveys, gages and studies  Total maintenance	\$680,000 240,000 1 970,000 100,000 448,000 350,000 510,000 112,000 550,000 550,000 50,000 15,000 90,000	\$3, 500, 000
The sum of \$4,800,000 can be profitable fiscal year 1947, as follows:  New work:  By contract, July 1, 1946, to June 30, 1947:  Chain of Rocks project:  Construction of bridge  Relocation of utilities  Commencement of channel excavation of the construction of the co	\$680,000 240,000 1 970,000 100,000 448,000 350,000 510,000 112,000 550,000 550,000 50,000 15,000 90,000	\$3,500,000

It is expected that with the proposed expenditures, the project will be about 80 percent complete.

an ne amue ao pere	ent comp	icte.				
	Cost and	financial su	mmary			
Cost of new work to Jur Cost of maintenance to J	ie 30, 1945 une 30, 194	5		\$	38, 9 32, 8	15, 544. 77 75, 413. 31
Total cost of pern Undistributed costs June	mont was	k to Tune 9	0.1045		71, 7	90, 958. 08 50, 000. 00
Net total cost to a Minus accounts payable	Tuna 20 10	45		<del></del> -	71, 9	40, 958. 08 35, 997. 19
Net total expendit Unexpended balance Jur	บาดต				71, 9	04, 960. 89 93, 124. 37
Total amount app					74, 2	98, 085. <b>2</b> 6
Fiscal year ending June 30	1941	1942	1943	194	•	1945
Cost of new work Cost of maintenance	\$000, 722. 54 725, 050. 05	\$558, 732, 47 891, 127, 93	\$980, 530. 26 673, 409. 97	\$409, 20 1, 212, 40	)8. 64 38. 36	\$643, 637. 88 978, 187. 54
Total cost	1, 715, 773. 49	1, 449, 860. 40	1, 051, 030. 23	1, 711, 67	77.00	1, 621, 825, 42
rotar expended	1, 564, 360, 93	1, 504, 454, 40	1, 982, 642. 26	1, 215, 60	18.81	1, 719, 137. 27
Allotted	1. 760. 000. 00	2, 034, 400, 00	1, 874, 000. 00	-450, 00	0.00	3, 800, 000. 00
Balance unexpended July Amount allotted from Wa Appropriation Act app Amount allotted from Wa Appropriation Act app	r Departm roved June r Departm	26, 1944 \$ ent Civil	2, 000, 000. 1, 800, 000.	00		2, 261. 64 0, 000. 00
Amount to be according amount expended _	unted for _		**************************************		4, 14	2, 261. 64 9, 137. 27
Bulance unexpende Outstanding liabilities Ju Amount covered by uncor	no 30 104	F.	\$1, 030. 381, 259.	03		3, 124. 37 2, 289. 69
Balance available J Amount allotted in July 1	Tune 30, 19 945	45			2, 01	0, 834. 68 0, 000. 00
Unobligated balance	e available	for fiscal y	ear 1946			0, 834. 68
Amount (estimated) required tion of existing project	ired to be a	ppropri <b>at</b> e		e-		5, 000. 00
Amount that can be profit: June 30, 1947: For new work *				8	-	
For new work <sup>2</sup> For maintenance <sup>2</sup>				} 1	, 500 . 300	), 000. 00 ), 000. 00
Total 3						

<sup>&</sup>lt;sup>1</sup> Includes \$6,260,604.83 from permanent indefinite appropriation covering snagging operations of which \$280,572.72 pertained to Vicksburg and Memphis districts.

\*\*Exclusive of available funds.\*\*

4, 800, 000, 00

Page	Flood control—Continued	Page
1373	27. Emergency protection for Illinois Approach Chain of	
1375	Flood Control Act ap-	
1377	1944)	1381
1379	surveys, and contingencies for flood control	1381
-,,-	the Flood Control Act approved August 28, 1937, as	1382
1380	30. Other flood control projects for which no estimates are	1383
	1375 1377 1379	27. Emergency protection for Illinois Approach Chain of Rocks Bridge (sec. 12, Flood Control Act ap- proved December 22, 1944) 28. Preliminary examinations, surveys, and contingencies for flood control 29. Snagging and clearing under authority of section 2 of the Flood Control Act ap- proved August 28, 1937, as amended 30. Other flood control projects

#### 1. MISSISSIPPI RIVER BETWEEN THE OHIO AND MISSOURI RIVERS

Location.—The Mississippi River rises in Lake Itasca, Minn., and, from that lake flows in a southerly direction about 2,350 miles and empties into the Gulf of Mexico. The portion included in this report embraces the 195-mile section known as the middle Mississippi, between the tributary Ohio and Missouri Rivers, about 980 to 1,175 miles from the Gulf.

Previous projects.—The original project for the improvement of the Mississippi River between the Ohio and Missouri Rivers was recommended by a board of engineers in a report, dated April 13, 1872, and concurred in by the Chief of Engineers. For further details see page 1879 of the Annual Report for 1915 and page 1014 of the

Annual Report for 1938.

Existing project.—This provides for obtaining and maintaining a minimum channel depth of not less than 9 feet, a minimum width of not less than 300 feet at low water, with additional width in bends from the mouth of the Ohio River (about 980 miles from the Gulf) to the northern boundary of the city of St. Louis, 191 miles; thence 200 feet wide, with additional width in bends to the mouth of the Missouri River, 4 miles; to be obtained: First, by regulating works, for closing sloughs and secondary channels, and narrowing the river; by building new banks where the natural width is excessive and protecting new and old banks from erosion where necessary to secure permanency; second, by dredging or other temporary expedients to maintain channels of project dimensions; third, by construction of works authorized for the Chain of Rocks reach in the River and Harbor Act of March 2, 1945, which approved a comprehensive plan for development of the Mississippi River at Chain of Rocks so as to provide for construction of a lateral canal at an estimated first cost to the United States of approximately \$10,290,000, with annual maintenance and operation cost of \$70,000, subject to such modification as the Chief of Engineers may find necessary when the project is undertaken; and to authorize the relocation of the river channel and reclamation of the area in Sawyer Bend for airport, park, recreational, and similar purposes at a cost to local interests of approximately \$17,555,000; provided that any modification of the present river

channel required by the civic development be deferred until completion of the lateral canal in the interest of navigation and that the river diversion work connected with such civic development be under the supervision of the Chief of Engineers in order to insure that the interests of interstate and foreign commerce be properly protected; and further provided that local interests hold and save the United States free from any claims for damages that might be incurred due to the construction, maintenance, or operation of such civic development or any part thereof (H. Doc. No. 231, 76th Cong., 1st sess.).

The estimated cost of new work, revised in 1946, is \$84,207,000, with

\$1,370,000 for annual maintenance.

The existing project was authorized by the following river and harbor acts:

	Acts	Work authorized	Documents
		Project for regulating works adopted in 1881. (To obtain a minimum depth of 8 feet.)	Annual Report, 1881, p. 1536.
June	3, 1890 13, 1902	Dredging introduced as part of the project	
Mar Mar	. 2, 1907 . 3, 1905 <sup>1</sup> . 2, 1907 <sup>1</sup>	These acts practically abrogated that part of the project for the middle Mississippi which proposed regulating works.	•
June	25, 1910	Regulating works restored to the project and appropriations begun with a view to the completion of the improvement between the Ohio and Missouri Rivers within 12 years at an estimated cost of \$21,000,000, exclusive of amounts previously expended.	H. Doc. No. 50, 61st Cong., 1st sess and H. Doc. No. 168, 58th Cong. 2d sess.
Jan,	21, 1927	For a depth of 9 feet and width of 300 feet from the Ohio River to the northern boundary of the city of St. Louis, with the estimated cost of main- tenance increased to \$900,000 annually.	Rivers and Harbors Committee Doo No. 9, 69th Cong., 2d sess.
July	3, 1930	Project between the northern boundary of the city of St. Louis and Grafton (mouth of Illinois River) modified to provide for a channel 9 feet deep and generally 200 feet wide with additional width around bends, at an estimated cost of \$1,500,000, with \$125,000 annually formaintenance.	Rivers and Harbors Committee Doe No. 12, 70th Cong., 1st sess.
Mar.	2, 1945	Modified to provide for construction of a lateral canal with lock at Chain of Rocks, at an estimated first cost to the United States of about \$10,290,000, with \$70,000 annually for maintenance and operation.	H. Doc. No. 231, 76th Cong., 1st sess.

<sup>&</sup>lt;sup>1</sup> Also joint resolution, June 29, 1906.

See House Document No. 669 (76th Cong., 3d sess.) for report of Chief of Engineers dated February 27, 1940, containing a general plan for improvement of the Mississippi River between Coon Rapids Dam and the mouth of the Ohio River for purposes of navigation, power development, the control of floods, and the needs of irrigation.

Terminal facilities. - Most of the water terminal and transfer facilities of the district are described in volumes 1 and 4 of the four-volume report of the Board of Engineers for Rivers and Harbors, entitled,

1344 REPORT OF CHIEF OF ENGINEERS, U. S. ARMY, 1946

"Survey of Terminals and Landings on the Inland Waterways of the United States." Data covering additional terminals are:

Locality	Distance above Cairo	Distance above Passes	Bank	Purpose for which used
Sohio Petroleum Dock, Birds Point, Mo. Allied Oil Terminal Co., Gale, Ili	Miles 1.8 46.5	Miles 965. 8 1, 010. 5	R L	Transfer of gasoline and oil from barge to bank.
Eddie Erlbacher, Boat Opr., Ma- chine Shop, Cape Girardeau, Mo.	52, 5	1, 016. 5	R	Transfer of crude oil from bank barge. Marine ways for handling heav towboats.

Operations and results during fiscal year.—Construction works were carried on by contract and hired labor with Government plant throughout the year with river stages suitable for construction 9 months of the year. Regulating works were maintained and project dimensions of channels were secured by dredging. The district's standard specifications for construction work were used. Location, quantities, and costs of open river regulating works follow:

Class of work and locality	Miles above	Dikes (hurdles)			
of note and locality	mouth of Ohio River	Number	Linear feet	Cost	
New work by contract: Hurricane Field-Thompson Towhead Schonimann. Kaskaskia Island-Sto Geneviove, III. Fish Bend-Pulltight Cornice Island Danby Landing	60, 4 112, 7~123, 0 130, 8 150, 0	3 8 2 1 8 8	1, 555 3, 345 1, 685 1, 640 4, 015 5, 665	\$55, 095, 4( 168, 045, 92 75, 033, 01 74, 355, 72 199, 682, 39 290, 462, 33 447, 90	
Total		30	17, 905	863, 122, 67	
New work by United States plant and hired labor: Dogfooth Bend Pulltight Total	23, 4 164, 7	2 1	. 63 <i>6</i> 100	44, 011, 39 4, 235, 20	
Total		3	735	48, 246, 59	
Maintenance by United States plant and hired labor			10, 220	1 299, 711, 53	

<sup>1</sup> Includes cost of screening 7,225 linear feet of dikes with mattress lumber.

Class of work and locality	Miles		Bank protection (revetment)						
	above mouth of Ohlo River	Number	Linear feet bank	Squares (100 square feet)		Toe piles bank	Cost		
			protec- tion	Mattress	Paving	protec- tion			
New work by contract: Price Landing-Goose Island Cape Girardeau-Wilkin-	27. 9				569		\$60, 597. 4		
SonDanby Landing	48-91 138	2	2, 110 1, 115	2,066 1,115	698 538		114, 409, 9 64, 364, 3		
		3	3, 225	3, 181	1, 805		239, 371. 7		
faintenance by United States plant and hired labor			11,760	424	3, 905	4, 130	1 190, 697. 4		

Includes cost of building 1,350 linear feet of abatis dike.

Maintenance.—Dikes and revetments were repaired at a cost of \$490,408.94. The required 9-foot channel was maintained, except for the short periods needed to move a dredge to the shoal, by three United States hydraulic dredges. During the year 27 shoals developed, of which 22 were dredged once, 1 was dredged twice, and 2 were There were 3,210,617 cubic yards of sand and gravel dredged 3 times. removed by these dredges from the channel through 27 bars; 33,531 cubic yards of material were removed in outside-the-channel dredging at a cost of \$18,005.33. The channels dredged had a combined length of 16.3 miles, an average width of 280 feet, and an average gain in depth of 6.8 feet. The total cost of maintenance dredging was

\$296,818,20.

Hydrographic surveys were made covering approximately 110 miles of river, costing \$37,276.45. Aids to navigation were installed at a cost of \$44,421.68. Other miscellaneous costs were: Snagging, \$138.51; cooperative stream gaging, \$7,385.14; discharge observations at miscellaneous localities, \$1,604.41; stream flow forecasting, \$3,-575.65; rock removal, \$1,518.61; gages, \$11,372.84; establishment of third order triangulation points, \$743.09; releasing grounded vessels, \$1,446.78; and safeguarding structures, \$7,148.63, all charged to maintenance. The total cost of all maintenance was \$903,858.93. The expenditures were \$2,553,928.39 from regular funds.

Condition at end of fiscal year.—Work under this project (including recently authorized Chain of Rocks improvement) is about 46 percent complete. The quantities required to complete the project are estimated at 180 dikes, 164,000 linear feet, 85 revetments, 86,000 linear feet, and the canal, lock, levees, etc., at Chain of Rocks as recommended in House Document No. 231. Dikes and revetments are now in good repair and the channel has been greatly improved by the work

that has been done. Dredging is required at low stages to remove temporary shoals and maintain the required channel depths.

In recent years, the project dimensions of channels have generally been maintained throughout the navigation season. The navigation season formerly extended from the middle of February to the middle of December, the river being generally closed by ice the remainder of the year. However, in recent years navigation has continued

throughout the winter, except when the river is actually blocked by running ice or gorges. The river is generally above the 10-foot stage, St. Louis gage, for 6 months of the year, latter part of February to latter part of August, during which time project channel depths generally prevail without dredging. The mean stage of the river for the fiscal year 1945 was 13.25 feet, St. Louis gage. The mean stage of the river for the fiscal year 1946 was 10.42 feet.

The following table gives condition of the channel during the

fiscal year 1946:

		Channel affording— 1								
Section .	Length of sec- tion			more Less than 9 feet		7 feet or less		6 feet or less		Con- troll- ing
		Length	Pc- riod	Longth	Pr- riod	Length	Pe- rlod	Length	Pe- riod	dept
Ohio River to Commercial	Miles	Miles	Days	Miles	Days	Miles	Days	Miles	Days	Feet
Point. Commercial Point to Com-	32, 7	32.7	365	0	0	0	0	0	0	12.0
merce. Commerce to Grays Point. Grays Point to Grand Tower. Grand Tower to Fort Gage. Fort Gage to Little Rock. Little Rock to River des Percs.	6. 7 6. 6 33. 7 36. 3 9. 5 46. 5	6. 7 6. 6 33. 7 36. 3 9. 6 40. 5	305 305 365 365 365 365	0 0 0 0	000000	0 0 0 0 0	00000	00000	0 0 0 0 0	10. 5 12. 0 9. 0 9. 0 10. 0
River des Peres to Merchants Bridge Merchants Bridge to north-	11.2	11.2	364	0, 1	1	0	0	ò	0	8.0
ern boundary city of St. Louis?  Northern boundary city of St. Louis to mouth of Mis-	8.0	7.9	362	0. 1	3	0	0	o	0	8. 6
souri River 2	3.8	3.8	365	0	0.	0	o l	0	0	11.0

<sup>&</sup>lt;sup>1</sup> Project width is 300 feet from Ohio River to northern boundary of St. Louis and 200 feet from that point to Missouri River, with additional width in bends throughout.

<sup>2</sup> This is known as the Chain of Rocks Reach.

The costs and expenditures under the existing project to June 30, 1946, have been as follows:

Kind of funds				
	New work	Maintenance	Total	Expenditures
Regular	\$34, 586, 999. 05 3, 462, 154. 46 996, 747. 95	\$28, 518, 667, 41	\$03, 105, 060, 46 3, 462, 154, 46 996, 747, 95	\$63, 322, 762. 38 3, 462, 154. 46 996, 747. 95
Total	39, 045, 901. 46	28, 518, 667, 41	67, 564, 568. 87	67, 781, 664, 79

Proposed operations.—The unexpended balance at end of fiscal year, plus \$764,000 allotted in July 1946, plus \$300,000 advanced to plant allotment will be applied as follows:

### RIVERS AND HARBORS—ST. LOUIS, MISSOURI, DISTRICT 1347

Accounts payable, June 30, 1946		\$82, 904. 08
New Work:		, , ,
By contract (completion of existing contracts), July 1 to Nov. 1, 1946:	-	
Piling dikes:	•	•
Schenimann.	\$44, 000. 00	<b>l</b> .
Dainy Danding	196, 000, 00	
Cornice Island	46, 500, 00	
Bank protection:	10,000,00	
Cape Girardeau-Wilkinson	13, 300, 00	
By contract, July 1, 1946, to June 30, 1947:	•	
Piling dikes:	4	
Dogtooth Bend	99, 000, 00	•
Chester Ste Genevieve, Mo	114, 000. 00	
Bank protection:	, 165, 000, 00	
Cape Girardeau-Wilkinson-Danby		. •
Landing	115 000 00	
Bridge over canal for Chain of Rocks:	115, 000. 00	
Bridge Highway (U. S. No. 66) con-		
tinuing contract, July 1, 1946, to		
. June 30, 1947	1, 200, 000. 00	
Lock at Chain of Rocks, continuing con-	.,,	
tract, July 1, 1946, to June 30, 1947	1, 264, 000. 00	
Unanging 10-inch gas pipe line of Missis-	• •	
sippi River Fuel Corp., Aug. 15, 1946,		
to May 15, 1947	165, 000. 00	•
Changing one 10-inch and one 16-inch oil pipe line of Shell Petroleum Corp.,	•	
Aug. 1, 1946, to May 1, 1947	900 000 00	
By hi ed labor with United States plant, July	220, 000. 00	
1, 1946, to June 30, 1947:		
Piling dikes:	•	
Pulltight	42, 300. 00	
Bank protection:	, 001 00	
Liberty Bend	35, 000, 00	•
Dredging with United States dredge in		
connection with new bank protection		
by contract and hired labor	<i>58, 500.</i> <b>00</b>	
Partial land acquisition, Chain of Rocks		
improvement, July 1, 1946, to June 30, 1947	900 000 00	
Partial dredging downstream approach to	300, 000. 00	*
lock, Chain of Rocks improvement,		
	288, 000. 00	
Design and studies, Chain of Rocks im-	200, 000, 00	
Design and studies, Chain of Rocks improvement, July 1, 1946, to June 30, 1947	_	
1947	120, 000, 00	
TO A A A		
Total for new work		4, 485, 600. 00
willintenance:		
By hired labor with United States plant,		
July 1, 1946, to June 30, 1947: Dikes and bank protection	0000 000 00	
Project channel dredging.	\$300, 000. 00	
Surveys, gages, and studies	400, 000, 00	
Aids to navigation	47, 000. 00 34, 000. 00	
Aids to navigation Establishment of third order triangula-	0 <del>1,</del> 000, 00	
tion points	22, 000, 00	•
Snagging	17, 300, 00	×
Cooperative stream gaging	14, 000, 00	
Discharge observations	5, 091, 90	
Stream flow forecasting	2, 300. 00	
Total maintanant		
Total maintenance		841, 691. 90
Total for all work.		E 410 105 00
Zour for an works and a second		5. 410, 195. 98
- · ·		

The sum of \$16,673,000 can be profitably expended during the fiscal year 1948, as follows:

year 1940, as 10110W	8:		• -		
New work:				••	
By contract, July	1. 1947 to	Tuna 20 10	do.		
Chain of Rock	s improven	oune ou, 19	40;		
Construct	ion of heids	MA	<b>e</b> ar	10.000	
TOTOGRETO	n or litilitie	<b>Q</b>	)7 E	00, 000 19, 000	
	aum en roese		2 00	N N N N N	
				10, 000 10, 000	
				4, 000	
~ J MICG IADDI WILL	I I HITEON ST	OTOD MIANEL		-, 000	
Onain of Rock	s improvem	ient:			
Land acqu	lisition		60	0, 000	
By contract:			30	0, 000	
Dikos	•			•	
Dikes	~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~		85	0, 000	
Bank protection By hired labor with	Tinital Ct.	-4	47	5, 000	
Dikes	omted Sti	ates plant:			
Dikes Bank protection			250	0, 000	
p. 000000	*******	~~~~~~.	128	5, 000	
Total for new	v work		•		
					\$15, 373, 00(
By hired labor with	United Sta	ites plant.			
Dank Sulte and Dank	Drotection	1	\$810	, 000	
Trolcor channie	areaging		126	, 000	
~ ~ · · · · · · · · · · · · · · · · · ·	CLISTI 201411111111111111111111111111111111111	N2	O.F	, 000	
Tananiiaiiiiieii (	ot taira ora	Ar trionmil	ation	, 000	•
DOMES				, 000	
TARGET OF THE VIRALI	VII		95	, 000	
			30	. 000	
	exili bunina		*^	, 000 , 000	
Stroom down for	vations		7	. 000	
, Discharge obser Stream flow for	ecasting		<b>5</b>	, 000	
Total mainter	30000				
2 Out manifel	Mile				1, 300, 000
Total for all v	YOLK		. ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ .		16, 673, 000
It is expected that cluding Chain of R	with the $\mathfrak p$	$\mathbf{proposed}$	xpenditu	17 1	
cluding Chain of R.	ocks imp	rovement	will be	ohout 7	O manage
complete,	Tour Ly	-010110110	, will no	anout 1	o percent
• • • • • • • • • • • • • • • • • • • •	Most and			•	
Cost of now work to Tour	Cost unu j	financial su	mmary		
Cost of maintenance to I	30, 1946			\$40,	462, 521, 12
Cost of new work to June Cost of maintenance to June Total cost of norm	uno 30, 194	6		<sup>1</sup> 33, '	779, 272, 24
Undistributed costs June Net total cost to June	30, 1946	~			300, 000, 00
Net total cost to J	une 30, 194	6		71	541 700 00
Minus accounts payable J	une 30, 19	46		14;	541, 793, 36
Net total expenditi	trop				82, 904, 08
Net total expenditu Unexpended balance June	30 1048			74, 4	158, 889, 28
Total amount annu	ammint of	Y	****	4, 6	346, 195, 98
Total amount appr	opriated to	June 30, 1	946	<sup>1</sup> 78, 8	305, 085, 26
Fiscal year ending June 30	1942			1	T
July of the order	1042	1943	1944	1945	1946
Cost of new work	A*** =00 12				
Cost of maintenance	\$558, 732, 47 891, 127, 93	\$980, 530, 26	\$499, 208. 64	\$643, 637. 88	\$1, 546, 976. 35
		673, 499, 97	1, 212, 468, 36	978, 187. 54	903, 858. 93
Total cost	1, 449, 860, 40	1, 654, 030, 23	1, 711, 677, 00	1, 621, 825, 42	2, 450, 335, 28
Total expended	1, 594, 454, 40	1, 982, 642, 26	1, 215, 608, 81	1 740 127 07	
Allotted				1, 749, 137. 27	2, 553, 928, 39
	2, 039, 400, 00	1, 574, 000, 00	-450, 000. 00	3, 800, 900. 00	4, 507, 000. 00
					1

Includes \$5,260,604.83 from permanent indefinite appropriation covering snagging operations, of which \$280,572.72 pertained to Vicksburg and Memphis districts.

# RIVERS AND HARBORS—ST. LOUIS, MISSOURI, DISTRICT 1349

, -		TO TO
Balance unexpended July 1, 1945Amount allotted during fiscal year	4, 515.	124, 37 000, 00
Amount to be accounted for	6, 908,	124. 37 000. 00
Net amount to be accounted forGross amount expended	6, 900,	124. 37 928. 39
Balance unexpended June 30, 1946 \$173, 830, 36 Outstanding liabilities, June 30, 1946 \$173, 830, 36 Amount covered by uncompleted contracts 304, 503, 66	4, 346,	195. 98
Balance available June 20, 1046	478,	334. 02
Balance available June 30, 1946  Amount allotted in July 1946	764, (	000. 00
Unobligated balance available for fiscal year 1947	4, 631,	861. <b>96</b>
Amount (estimated) required to be appropriated for completion of existing project 2	40, 675, (	000. 00
Amount that can be profitably expended in fiscal year ending June 30, 1948:  For new work 2  For maintenance 2		
	15, 373, 0 1, 300, 0	)00. 00
Total <sup>2</sup> Exclusive of available funds.	16, 673, 0	00. 00
a material at		

2. MİSSISSIPPI RIVER BETWEEN MOUTH OF MISSOURI RIVER AND MINNEAPOLIS, MINN. (ST. LOUIS DISTRICT)

See report, "Mississippi River between the Missouri River and Minneapolis, Minn.," page 1385.

3. ILLINOIS WATERWAY, ILL. (ST. LOUIS DISTRICT)

See report, "Illinois Waterway, Ill.," page 1972.

4. EXAMINATIONS, SURVEYS, AND CONTINGENCIES (GENERAL)

The cost of work during the year was \$79,093.66, and the expenditures were \$71,396.27. The balance unexpended at the end of the fiscal year, including accounts receivable, will be applied as needed during the fiscal year 1947 to payment of expenses to be incurred under this heading. The additional sum of \$97,000 can be profitably expended during the fiscal year ending June 30, 1948.

#### Cost and financial summary

Cost of new work to June 30, 1946Cost of maintenance to June 30, 1946	\$814, 039, 69
Total cost of permanent work to June 30, 1946Plus accounts receivable June 30, 1946	814, 039. 69 1, 387. 68
Gross total costs to June 30, 1946	815, 427. 37

Flood control—Continued	Flood control—Continued	n 1°
20. Harrisonville and Ivy Land- ing drainage and levee	28. Emergency flood-control work	ge
	under authority of Public Laws Nos. 138 and 318,	
district No. 3, Illinois 22. Wilson and Wenkel and	Seventy-eighth Congress, and Public Law No. 75, Seventy-ninth Congress,	
Prairie du Pont drainage and levee districts, Illinois 23. East St. Louis and vicinity,	1377 and Public Law No. 102, Eightieth Congress 139	36
Illinois. 24. Chouteau Nameoki and Ven-	1379 Preliminary examinations, surveys, and contingencies for flood control 138	
ice drainage and levee district Illinois	30. Snagging and clearing under authority of section 2 of	13
<ul> <li>25. Wood River drainage and levee district, Illinois 1</li> <li>26. Upper Mississippi River Ba-</li> </ul>	the Flood Control Act approved August 28, 1937	
sin, St. Louis district 1  27. Emergency flood-control work		8
under authority of the Flood Control Act an-	for which no estimates are submitted 1390	Ő
proved August 18, 19411	385	٠.,

### 1. MISSISSIPPI RIVER BETWEEN THE OHIO AND MISSOURI RIVERS

Location.—The Mississippi River rises in Lake Itasca, Minn., and, from that lake flows in a southerly direction about 2,350 miles and empties into the Gulf of Mexico. The portion included in this report embraces the 195-mile section known as the middle Mississippi, between the tributary Ohio and Missouri Rivers, about 984 to 1,179 miles from the Gulf.

Previous projects.—The original project for the improvement of the Mississippi River between the Ohio and Missouri Rivers was recommended by a board of engineers in a report, dated April 13, 1872, and concurred in by the Chief of Engineers. For further details see page 1879 of the Annual Report for 1915 and page 1014 of the Annual Report for 1938.

Existing project.—This provides for obtaining and maintaining a minimum channel depth of not less than 9 feet, a minimum width of not less than 300 feet at low water, with additional width in bends from the mouth of the Ohio River (about 980 miles from the Gulf) to the northern boundary of the city of St. Louis, 191 miles; thence 200 feet wide, with additional width in bends to the mouth of the Missouri River, 4 miles; to be obtained: First, by regulating works, for closing sloughs and secondary channels, and narrowing the river; by building new banks where the natural width is excessive and protecting new and old banks from erosion where necessary to secure permanency; second, by dredging or other temporary expedients to maintain channels of project dimensions; third, by construction of works authorized for the Chain of Rocks reach in the River and Harbor Act of March 2, 1945, which approved a comprehensive plan for development of the Mississippi River at Chain of Rocks so as to provide for construction of a lateral canal at an estimated first cost to the United States of approximately \$10,290,000, with annual maintenance and operation cost of \$70,000, subject to such modification as the Chief of Engineers may find necessary when the project is under-

taken; and to authorize the relocation of the river channel and reclamation of the area in Sawyer Bend for airport, park, recreational, and similar purposes at a cost to local interests of approximately \$17,555,000; provided that any modification of the present river channel required by the civic development be deferred until completion of the lateral canal in the interest of navigation and that the river diversion work connected with such civic development be under the supervision of the Chief of Engineers in order to insure that the interests of interstate and foreign commerce be properly protected; and further provided that local interests hold and save the United States free from any claims for damages that might be incurred due to the construction, maintenance, or operation of such civic development or any part thereof (H. Doc. 231, 76th Cong., 1st sess.).

The estimated cost of new work, revised in 1947, is \$93,521,000, with

\$1,370,000 for annual maintenance.

The existing project was authorized by the following river and harbor acts:

A	cts	Work authorized	Documents
June June 1 Mar.	3, 1902	Project for regulating works adopted in 1881. (To obtain a minimum depth of 8 feet.)  Dredging introduced as part of the project	Annual Report, 1881, p. 1536,
Mar. 3, Mar. 2, June 2	1905 1 1907 1	These acts practically abrogated that part of the project for the middle Mississippi which proposed regulating works.  Regulating works restored to the project and appropriations begun with a view to the completion of the improvement between the Ohio and Missouri Rivers within 12 years at an estimated cost of \$21,000,000, exclusive of amounts previously ex-	
	, 1927	For a depth of 9 feet and width of 300 feet from the Oblo River to the northern boundary of the city of St. Louis, with the estimated cost of maintenance increased to \$900.000 annualty.	Rivers and Harbors Committee Doc. 9, 69th Cong., 2d sess.
	1930	St. Louis and Grafton (mouth of Illinois River) modified to provide for a channel 9 feet deep and generally 200 feet wide with additional width around bends, at an estimated cost of \$1,500,000, with \$125,000 annually for mentages.	Rivers and Harbors Committee Doc. 12, 70th Cong., 1st sess.
Mar. 2,	1945	Modified to provide for construction of a lateral canal with lock at Chain of Rocks, at an estimated first cost to the United States of about \$10,290,000, with \$70,000 annually for maintenance and operation.	H. Doc. 231, 76th Cong., 1st sess.

<sup>1</sup> Also joint resolution, June 29, 1906.

See House Document 669 (76th Cong., 3d sess.) for report of Chief of Enginers dated February 27, 1940, containing a general plan for improvement of the Mississippi River between Coon Rapids Dam and the mouth of the Ohio River for purposes of navigation, power development, the control of floods, and the needs of irrigation.

Terminal facilities. - Most of the water terminal and transfer facilities of the district are described in volumes 1 and 4 of the four-volume report of the Board of Engineers for Rivers and Harbors, entitled "Survey of Terminals and Landings on the Inland Waterways of the United States."

Operations and results during fiscal year.—River stages were favorable to construction work by contact and hired labor with Government plant during the fall of 1946. However, due to high river stages between April and June 1947 work was carried on only intermittently. Regulating works were maintained and project dimensions of channels were secured by dredging. The districts standard specifications for construction work were used. Location, quantities, and costs of open river regulating works follow:

Class of work and locality	Miles above	Dikes (hurdles)			
o will sid locality	mouth of Ohio River	Number	Linear feet	Cost	
New work by contract: Dogtooth Bend Schenimann	26			\$162.31	
Chester-Ste. Genevieve, Mo. Danby Landing Cornice Island	59-61 119-124 143-146	4	1, 575 2, 690	41, 564, 4 176, 171, 6 223, 993, 1	
Total	160	1	60 4, 325	40, 878, 90 482, 767, 53	
New work by United States plant and hired labor: Pulitight. Maintenance by United States plant and hired labor	164-165	2	550	32, 808. 80	
The states plant and hired labor			6, 305	1 171, 539, 08	

<sup>&</sup>lt;sup>1</sup> Includes cost of screening 3,325 linear feet of dikes with mattress lumber.

Class of work and locality	23400	В	ank prot	ection (r	evetmen	<b>t)</b>		
	Miles above mouth of Ohlo	above mouth of Ohio		inear squar feet squar		Toe piles	Cost	
	River	A CAME DOL	protec- tion	Mat- tress	Paving	bank protec- tion		
New work by contract: Cape Girard- eau-Wilkinson	90.5				58		<b>21</b> 4:000 =	
New work by United States plant and hired labor: Liberty Bend Danby Landing	99. 5 138. 5	1 1	595 720	541 718	391 292		\$14, 663, 7 31, 148, 66 31, 856, 04	
Total		2	1, 315	1, 256	683		63, 004, 73	
Maintenance by United States plant and bired labor			13, 404	1, 228	3, 985	4, 920	195, 978. 00	

New work: Two dikes, totaling 550 feet in length, were built by hired labor with Government plant; at a cost of \$32,808.80. Two revetments, totaling 1,315 feet in length, consisting of 1,256 squares of mattress and 683 squares of paving were built by hired labor with Government plant, at a cost of \$63,004.73. A total of 354.231 cubic yards of material was handled by a United States hydraulic dredge in preparing two localities for new regulating works at a cost of \$43,503. Eleven dikes, totaling 4,325 feet in length, were built under contract at a cost of \$482,767.53. One revetment, consisting of 56 squares of paving was completed under contract at a cost of \$14,663.71. In addition to complete work there was under construction

by contract, 12 dikes to total about 9,340 linear feet. Costs of \$1,389,30.40 were incurred on the improvement at Chain of Rocks as follows: By contract, relocation of utilities, \$70,095.02 and construction of bridge over canal, \$251,338.91. By hired labor, dredging lower approach to canal, removing 2,953,583 cubic yards of material, \$530,765.89, dredging 41,106 cubic yards for relocation of utilities, \$7,889.34; purchase of 1,513.22 acres of land; \$236.491.77; abstract of titles, \$11,500.34, appraisals and negotiations, \$9,161.97, legal and administrative expense \$3,322.96 and miscellaneous office and field costs in connection with land acquisition, \$32,711.84; engineering, design and studies, \$221,370.34 and miscellaneous construction surveys, \$13,782.02. The total cost of new work was \$2,026,078.17, from regular funds.

Maintenance: Dikes and revetments were repaired at a cost of \$367,517.08. The required 9-foot channel was maintained, except for the short periods needed to move a dredge to the shoal, by four United States hydraulic dredges. During the year 21 shoals developed, of which 17 were dredged once and 2 were dredged twice. There were 2,007,447 cubic yards of sand and gravel removed by these dredges from the channel through 21 bars. The channels dredged had a combined length of 9.8 miles, an average width of 350 feet, and an average gain in depth of 5.4 feet. The total cost of maintenance dredge-

ing, was \$222,502.53.

Hydrographic surveys were made covering approximately 200 miles of river, costing \$88,951.87. Aids to navigation were installed at a cost of \$23,133.47. Other miscellaneous costs were: Snagging, \$1,952.99; cooperative stream gaging, \$8,691.69; discharge observations at miscellaneous localities, \$1,146.04; stream flow forecasting, \$6,708.85; removal of 4,124 cubic yards of rock, \$1,851.08; gages, \$11,875.76 and releasing grounded vessels, \$1,399.09, all charged to maintenance. The total cost of all maintenance was \$735,730.45. The

expenditures were \$2,678,477.94 from regular funds.

Condition at end of fiscal year.—Work under this project (including the authorized Chain of Rocks improvement), is about 49 percent complete. The quantities required to complete the project are estimated at 170 dikes, 159,000 linear feet; 82 revetments, 85,000 linear feet, and the canal, lock, levees, etc., at Chain of Rocks as recommended in House Document 231. Dikes and revetments are now in good repair and the channel has been greatly improved by the work that has been done. Dredging is required at low stages to remove temporary shoals and maintain the required channel depths.

In recent years, the project dimensions of channels have generally been maintained throughout the navigation season. The navigation season formerly extended from the middle of February to the middle of December, the river being generally closed by ice the remainder of the year. However, in recent years navigation has continued throughout the winter, except when the river is actually blocked by running ice or gorges. The river is generally above the 10-foot stage, St. Louis gage, for 6 months of the year, latter part of February

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to latter part of August, during which time project channel depths generally prevail without dredging. The mean stage of the river for the fiscal year 1946 was 10.42 feet, St. Louis gage. The mean stage of the river for the fiscal year 1947 was 12.42 feet.

The following table gives condition of the channel during the fiscal

				Ohi	innel a	fording-	-1			
Section	Length of sec- tion	A reer or more		Less than 9 feet		7 feet or less		6 feet or less		Con- trol- ling
		Length	Peri- od	Length	Perl- od	Length	Peri- od	Length	Peri-	depth
Ohlo River to Commercial	Miles	Miles	Days	Miles	Days	Miles	Days	Miles	Days	Feet
Point Commercial Point to Com-	32, 7	32.7	365	O_	0	0	0	0	0	10. (
merce Commerce to Grays Point Grays Point to Grand	6. 7 6. 6	6. 7 6. 6	363 365	0.1 0	2 0	0 0	0	0- 0	0 0	8. ( 10. <i>l</i>
Tower. Grand Tower to Fort Gage. Fort Gage to Little Rock Little Rock to River des	33, 7 36, 3 9, 5	33. 7 36. 3 9. 5	364 365 365	0. 1 0 0	1 0 0	0 0 0	0 0 0	0 0 0	0	8. ( 10. ( <b>9.</b> (
Peres :: River des Peres to Mer-	46. 5	46, 5	365	0	o	0	0	0	o	9. 0
chants Bridge Merchants Bridge to north- ern boundary city of St.	11.2	11, 2	365	0	0	0	0	0	0	13. 5
Louis 1	8.0	7.9	364	0.1	2		Ó	. 0	0	8.6
St. Louis, to mouth of Missouri River !	3,8	3.8	365	0	0	0	0	0	0	9.0

<sup>&</sup>lt;sup>1</sup> Project width is 300 feet from Ohio River to northern boundary of St. Louis and 200 feet from that point to Missouri River, with additional width in bends throughout.

<sup>2</sup> This is known as the Chain of Rocks Reach.

The cost and expenditures under the existing project to June 30, 1947, have been as follows:

Kind of funds	Secretary Secre			
	New work	Maintenance	Total	Expenditures
Regular Public Works Emergency Relief	\$36, 613, 077, 22 3, 462, 154, 46 996, 747, 95	\$29, 254, 397. 86	\$65, 867, 475, 08 3, 462, 154, 46 996, 747, 95	\$66,001,240.32 3,462,154.46 996,747.95
Total	41, 071, 979. 63	29, 254, 397. 86	70, 326, 377. 49	70, 460, 142. 73

Proposed operations.—The unexpected balance at the end of the fiscal year, plus \$5,527,000 allotted in August 1947, and \$168,243.03 advanced to plant allotment, will be applied as follows:

# RIVERS AND HARBORS—ST. LOUIS, MISSOURI, DISTRICT 1349

Accounts payable, June 30, 1947		234 477 70
New work		
Regulating works:		*
By contract (completion of existing co	ntracta), July 1,	
1947, to June 30, 1948; Piling dikes;		N A
Dogtooth Bend	807 040 AA	<i>r</i> :
Chester-Ste. Genevieve, Mo.	- \$87, 862, 00 252, 232, 00	
By contract July 1, 1947, to June 20, 104	252, 233. 00	
Piling dikes:		
Goose Island	113, 100, 00	à.
Schenimann	203 000 00	•
Grand Tower and Hanging Do	g Line	-
Island		?.
	223 884 00	· F
Bank protection: Dogtooth Bend.	- 54, 000, 00	
Chair of Itoeks improvement:		
Bridge Highway (U. S. No. 66) continuin	8	
contract: July 1, 1947, to June 30		•
1948  Lock, continuing contract: July 1, 1947	_ 1, 453, 661. 00	
to June 30, 1948		
Utilities, relocation of 54-inch water line	<b>- 3, 700, 000. 00</b>	
continuing contract: Nov. 1, 1947, to		
June 30, 1948	900 000 00	
Utilities, complete relocation of gas-pipe	200, 000. 00	ь.
line: July 1, 1947, to Aug. 30, 1947	11, 115. 00	
Utilities, payment to East St. Louis and	11, 110, 00	
Interurban Water Co., for purchase of		
2 water lines: July 1, 1947, to Oct. 10.		
1947. 1.21.1122. 11.122. 12.13. 13. 13. 13. 13. 13. 13. 13. 13. 13.	105 000 00	
Utilities, payment to Mississippi River		
ruel Corp. for relocation of Shell Oil		
line: July 1, 1947, to Apr. 30, 1948	150, 000, 00	
By hired labor with United States plant:		
Regulating works, July 1, 1947, to June		
30, 1948: piling dikes, Cornice Island_	24, 000. 00	
Chain of Rocks improvement:		
Partial land acquisition, July 1, 1947, to Feb. 1, 1948		
Construction surveys, July 1, 1947, to	50, 000. 00	
June 30, 1948	EO 000 00	
Advance planning, July 1, 1947, to June	50, 000. 00	
30, 1948	80, 000. 00	
	00, 000. 00	
Total for new work	A	, 958, 535. 00
Maintenance		, 800, 000. 00
By nired labor with United States plant. July	•	
1, 1947, to June 30, 1948;	refreda la vista	•
Dikes and bank protection	\$537, 000, 00	
Project channel dredging	ARA BOO OO	
Surveys, gages, and studies	90, 000, 00	
Aids to navigation	ວບ, ບບບ. ບບ	
Subvence	20, 000. 00	
Cooperative stream gaging	18, 000, 00	*
Discharge observations Stream flow forecasting	a, 000. 00	
COLUMN TOTACHER TOTACHER	3, 000. 00	
Total maintenance		188 000 00
Unallocated balance	li	156, 000. 00
Total for all work		1, 948, 28

### 1350 REPORT OF CHIEF OF ENGINEERS, U. S. ARMY, 1947

The sum of \$14,620,000 can be profitably expended during the fiscal year 1949, as follows:

New work:		
	A STATE OF THE STA	
By contract, July 1, 1948, to June 30, 1949:		
Chain of Rocks improvement:	المهيونة والمراقبة	en e
Chain of Rocks improvement:  Construction of lock  Relocation of Willitia	\$8 570 000	r e
Construction of canal Advance plaining (dam)	500, 000	
Advance planning (dam)	2, 000, 000	)4.7 -
Construction attended	110, 000	); *
Construction surveys	80, 000	) ·
By hired labor with United States plant: Chain of		
Rocks improvement, land acquisition	360, 000	<b>}</b>
By contract: Dikes	and a	3
DIRes	707, 000	Pr 1
DBUK Drotection	525, 900	
Dy micu labor with United States blooks		*
DikesBank protection	900 000	i t
Bank protection	290, 000	٠.
	176, 500	n.
Total for now work		
Total for new work		\$13, 320, 00
		• • • •
By hired labor with United States plant:		18 18 A 1 2 1
Dikes and bank protection Project channel dredging Surveys ages and study	661,000	
Trolect channel dredging	450 000	
Suitera Eagla, and Simple	95,000	
Aids to navigation	95, 000 45, 000	STARRED A
Cooperative stream gaging Discharge observe flore	20, 000	
Discharge observations	18, 000	
Discharge observations	3, 000	
Stream flow forecasting	8, 000	
		and the second of the second
Total maintenance		1 200 000
Total maintenance		1, 300, 00
Total maintenance  Total for all work		1, 300, 00
Total maintenance		
Total maintenance  Total for all work  It is expected that with the proposed expendituation of Rocks improvement) will complete.	Trac than	mainat (in
Total maintenance  Total for all work  It is expected that with the proposed expenditicluding revised Chain of Rocks improvement) will complete.  Cost and financial summary	ares, the p	roject (in- 51 percent
Total maintenance  Total for all work  It is expected that with the proposed expenditicluding revised Chain of Rocks improvement) will complete.  Cost and financial summary	ares, the p	roject (in- 51 percent
Total maintenance  Total for all work  It is expected that with the proposed expenditicluding revised Chain of Rocks improvement) will complete.  Cost and financial summary	ares, the p	roject (in- 51 percent
Total maintenance  Total for all work  It is expected that with the proposed expenditicluding revised Chain of Rocks improvement) will complete.  Cost and financial summary	ares, the p	roject (in- 51 percent
Total maintenance  Total for all work  It is expected that with the proposed expendita cluding revised Chain of Rocks improvement) will complete.  Cost and financial summary  Cost of new work to June 30, 1947  Cost of maintenance to June 30, 1947	ares, the p I be about	roject (in- 51 percent 488, 599, 29 515, 002, 69
Total maintenance  Total for all work  It is expected that with the proposed expendition of Rocks improvement) will complete.  Cost and financial summary  Cost of new work to June 30, 1947  Cost of maintenance to June 30, 1947  Total cost of permanent work to June 30, 1947	1res, the p l be about \$42, 134,	roject (in- 51 percent 488, 599, 29 515, 002, 69
Total maintenance  Total for all work  It is expected that with the proposed expenditiculating revised Chain of Rocks improvement) will complete.  Cost and financial summary  Cost of new work to June 30, 1947  Total cost of permanent work to June 30, 1947  Undistributed costs June 30, 1947.	ares, the pil be about	roject (in- 51 percent 488, 599, 29 515, 002, 69 003, 601, 98
Total maintenance  Total for all work  It is expected that with the proposed expenditiculating revised Chain of Rocks improvement) will complete.  Cost and financial summary  Cost of new work to June 30, 1947  Total cost of permanent work to June 30, 1947  Undistributed costs June 30, 1947.	ares, the pil be about	roject (in- 51 percent 488, 599, 29 515, 002, 69 003, 601, 98
Total maintenance  Total for all work  It is expected that with the proposed expendita cluding revised Chain of Rocks improvement) will complete.  Cost and financial summary  Cost of new work to June 30, 1947  Total cost of permanent work to June 30, 1947  Undistributed costs June 30, 1947  Net total cost to June 30, 1947	ares, the pil be about	roject (in- 51 percent 488, 599, 29 515, 002, 69
Total maintenance  Total for all work  It is expected that with the proposed expendite cluding revised Chain of Rocks improvement) will complete.  Cost and financial summary  Cost of new work to June 30, 1947  Cost of maintenance to June 30, 1947  Undistributed costs June 30, 1947  Net total cost to June 30, 1947	\$42, 1 34,	roject (in- 51 percent 488, 599, 29 515, 002, 69 003, 601, 98 168, 243, 03
Total maintenance.  Total for all work.  It is expected that with the proposed expenditicle cluding revised Chain of Rocks improvement) will complete.  Cost and financial summary  Cost of new work to June 30, 1947.  Cost of maintenance to June 30, 1947.  Undistributed costs June 30, 1947.  Net total cost to June 30, 1947.  Minus accounts payable June 30, 1947.	\$42, 1 34,	roject (in- 51 percent 488, 599, 29 515, 002, 69 003, 601, 98 168, 243, 03 171, 845, 01 34, 477, 79
Total maintenance.  Total for all work.  It is expected that with the proposed expenditicle cluding revised Chain of Rocks improvement) will complete.  Cost and financial summary  Cost of new work to June 30, 1947.  Cost of maintenance to June 30, 1947.  Undistributed costs June 30, 1947.  Net total cost to June 30, 1947.  Minus accounts payable June 30, 1947.	\$42, 1 34,	488, 599, 29 515, 002, 69 003, 601, 98 168, 243, 03 171, 845, 01 34, 477, 79
Total maintenance.  Total for all work.  It is expected that with the proposed expenditicle cluding revised Chain of Rocks improvement) will complete.  Cost and financial summary  Cost of new work to June 30, 1947.  Cost of maintenance to June 30, 1947.  Undistributed costs June 30, 1947.  Net total cost to June 30, 1947.  Minus accounts payable June 30, 1947.	\$42, 1 be about	roject (in- 51 percent 488, 599, 29 515, 002, 69 003, 601, 98 168, 243, 03 171, 845, 01 34, 477, 79
Total maintenance  Total for all work  It is expected that with the proposed expendite cluding revised Chain of Rocks improvement) will complete.  Cost and financial summary  Cost of new work to June 30, 1947  Cost of maintenance to June 30, 1947  Undistributed costs June 30, 1947  Net total cost to June 30, 1947	\$42, 1 be about	roject (in- 51 percent 488, 599, 29 515, 002, 69 003, 601, 98 168, 243, 03 171, 845, 01 34, 477, 79
Total for all work.  It is expected that with the proposed expenditicluding revised Chain of Rocks improvement) will complete.  Cost and financial summary  Cost of new work to June 30, 1947  Cost of maintenance to June 30, 1947  Total cost of permanent work to June 30, 1947  Undistributed costs June 30, 1947  Net total cost to June 30, 1947  Net total expenditures  Unexpended balance June 30, 1947	\$42, 1 be about \$42, 1 34, 1 77, 1 77, 2,	roject (in- 51 percent 488, 599, 29 515, 002, 69 003, 601, 98 168, 243, 03 171, 845, 01 34, 477, 79 137, 367, 22 155, 718, 04
Total maintenance.  Total for all work.  It is expected that with the proposed expenditicle cluding revised Chain of Rocks improvement) will complete.  Cost and financial summary  Cost of new work to June 30, 1947.  Cost of maintenance to June 30, 1947.  Undistributed costs June 30, 1947.  Net total cost to June 30, 1947.  Minus accounts payable June 30, 1947.	\$42, \$42, \$34, 77, 77,	488, 599, 29 515, 002, 69 003, 601, 98 168, 243, 03 171, 845, 01 34, 477, 79 137, 367, 22 155, 718, 04

		Fiscal	year ending Ju	ne 30—	
	1943	1944	1945	1946	1947
Cost of new work	\$980, 530, 26 673, 499, 97	\$499, 208, 64 1, 212, 468, 36	\$643, 637, 88 978, 187, 54	\$1,546,976.35 903,858.93	\$2, 026, 078, 17 735, 730, 46
Total cost.	1, 654, 030, 23	1,711,677.00	1, 621, 825, 42	2, 450, 835, 23	2, 761, 808. 62
Total expended	1, 982, 642. 26	1, 215, 608. 81	1, 749, 137. 27	2, 553, 928. 39	2, 678, 477. 94
Allotted	1, 574, 000. 00	-450, 000. 00	3, 800, 000. 60	4, 507, 000. 90	788, 000. 90
Balance unexpended July Amount allotted during fi	1, 1946 scal year			\$4, 3 	46, 195. 98 88, 000. 00
Amount to be acco Gross amount expended. Less reimbursed expenditu			\$2, 679, 258	3. 58 ). 64	34, 195. 98 78, 477. 94
Balance unexpende Outstanding liabilities, Ju Amount covered by uncon	ne 30, 1947_		\$34, 477 2, 421, 240	7. 79 ). 25	55, 718, 04 55, 718, 04
Amount allotted in August Unobligated balance		or fiscal ye	ar 1948	5, 52	7, 000, 00 7, 000, 00
Amount (estimated) requir of existing project 2	ed to be ap	propriated	for comple	tion 45, 48	9, 477. 00
Amount that can be profi June 30, 1949: For new work 2 For maintenance 2	بدر ۱۹۹۰ کوید مدن بوید بدلا بدو ۱۹۹۰ کا در سر مدا			13, 32	0, 000: 00 0, 000. 00
Total				14, 62	0, 000. 00
Exclusive of available funds.	in the second of			n	sar Sarang Bara

#### 2. MISSISSIPPI RIVER BETWEEN THE MISSOURI RIVER AND MINNE-APOLIS, MINN. (ST. LOUIS DISTRICT)

See report, "Mississippi River between the Missouri River and Minneapolis, Minn." page 1393.

3. ILLINOIS WATERWAY, ILL. (ST. LOUIS DISTRICT)

See report, "Illinois Waterway, Ill.," page 2035.

### 4. EXAMINATIONS, SURVEYS, AND CONTINGENCIES (GENERAL)

The cost of work during the year was \$121,771.22, and the expenditures were \$121,083.54. The balance unexpended at the end of the fiscal year, plus \$127,500 which was allotted in August 1947, will be applied as needed during the fiscal year 1948 to payment of expenses incurred under this heading.

The additional sum of \$203,600 can be profitably expended during the fiscal year ending June 30, 1949.

				,	
	Flood-control—Continued	Page	ĺ	Flood control—Continued	
21.		A DIES	28.	Emergency flood-control work	Page
22.	district No. 3, Illinois Wilson and Wenkel and	1535	1	under authority of Public	
,	Prairie du Pont drainage		ĺ	Laws Nos. 138 and 318, Seventy-eighth Congress,	
29	and levee districts. Illinois	1537		Public Law No. 75. Sev-	
	East St. Louis and vicinity, Illinois	1539		enty-ninth Congress, and	
24.	Chouteau, Nameoki, and	1000		Public Law No. 102, Eightieth Congress	1547
	Venice drainage and levee district, Illinois	1 2 4 1	29,	Preliminary examinations.	1041
25.	Wood River drainage and	1541		surveys, and contingencies	1510
26.	levee district. Illinois	1542	80.	for flood control Snagging and clearing under	1549
.40,	Upper Mississippi River Basin, St. Louis district	1844		authority of section 2 of	
27.	Emergency flood-control work	1544		the Flood Control Act approved August 28, 1937,	
	under authority of the			as amended	1550
	Flood Control Act approved August 18, 1941	1546	31.	Inactive flood-control proj-	
		TORU		ects	1551

### 1. MISSISSIPPI RIVER BETWEEN THE OHIO AND MISSOURI RIVERS

Location.—The Mississippi River rises in Lake Itasca, Minn., and, from that lake flows in a southerly direction about 2,350 miles and empties into the Gulf of Mexico. The portion included in this report embraces the 195-mile section known as the middle Mississippi, between the tributary Ohio and Missouri Rivers, about 984 to 1,179 miles from the Gulf.

Previous projects.—The original project for the improvement of the Mississippi River between the Ohio and Missouri Rivers was recommended by a board of engineers in a report, dated April 13, 1872, and concurred in by the Chief of Engineers. For further details see page 1879 of the Annual Report for 1915 and page 1014 of the Annual Report for 1938.

Existing project.—This provides for obtaining and maintaining a minimum channel depth of not less than 9 feet, a minimum width of not less than 300 feet at low water, with additional width in bends from the mouth of the Ohio River (about 980 miles from the Gulf) to the northern boundary of the city of St. Louis, 191 miles; thence 200 feet wide, with additional width in bends to the mouth of the Missouri River, 4 miles; to be obtained: First, by regulating works, for closing sloughs and secondary channels, and narrowing the river; by building new banks where the natural width is excessive and protecting new and old banks from erosion where necessary to secure permanency; second, by dredging or other temporary expedients to maintain channels of project dimensions; third, by construction of works authorized for the Chain of Rocks reach in the River and Harbor Act of March 2, 1945, which approved a comprehensive plan for development of the Mississippi River at Chain of Rocks so as to provide for construction of a lateral canal at an estimated first cost to the United States of approximately \$10,290,000, with annual maintenance and operation cost of \$70,000, subject to such modification as the Chief of Engineers may find necessary when the project is undertaken; and to authorize the relocation of the river channel and reclamation of the area in Sawyer Bend for airport, park, recreational, and similar purposes at a cost to local interests of approximately \$17,555,000; provided that any modification of the

present river channel required by the civic development be deferred until completion of the lateral canal in the interest of navigation and that the river diversion work connected with such civic development be under the supervision of the Chief of Engineers in order to insure that the interests of interstate and foreign commerce be properly protected; and further provided that local interests hold and save the United States free from any claims for damages that might be incurred due to the construction, maintenance, or operation of such civic development or any part thereof (H. Doc. 231, 76th Cong., 1st sess.).

The estimated cost of new work, revised in 1948, is \$93,173,000,

with \$1,370,000 for annual maintenance.

The existing project was authorized by the following river and harbor acts:

Acts	Work authorized	Documents
June 3, 1896 June 13, 1902	Project for regulating works adopted in 1881. (To obtain a minimum depth of 8 feet.)  Dredging introduced as part of the project.	Annual Report, 1881, p. 1536.
Mar. 2, 1907 Mar. 3, 1905 Mar. 2, 1907	These acts practically abrogated that part of the project for the middle Mississippi which proposed regulating works.	·
June 25, 1910	Regulating works restored to the project and appropriations begun with a view to the completion of the improvement between the Ohio and Missouri Rivers within 12 years at an estimated cost of \$21,000,000, exclusive of amounts previously expended.	H. Doc. 50, 61st Cong., 1st sess., and H. Doc. 168, 58th Cong., 2d sess.
Jan. 21, 1927	For a depth of 9 feet and width of 300 feet from the Ohio River to the northern boundary of the city of St. Louis, with the estimated cost of maintenance increased to \$900,000 annually.	Rivers and Harbors Committee Doc. 9, 69th Cong., 2d sess.
July 3, 1930	Project between the northern boundary of the city of St. Louis and Grafton (mouth of Illinois River) modified to provide for a channel 9 feet deep and generally 200 feet wide with additional width around bends, at an estimated cost of \$1,500,000, with \$125,000 annually for maintenance.	Rivers and Harbors Committee Doc. 12, 70th Cong., 1st sess.
Mar. 2, 1945	Modified to provide for construction of a lateral canal with lock at Chain of Rocks, at an estimated first cost to the United States of about \$10,290,000, with \$70,000 annually for maintenance and operation.	H. Doc. 231, 76th Cong., 1st sess.

<sup>&</sup>lt;sup>1</sup> Also joint resolution, June 29, 1906.

See House Document 669 (76th Cong., 3d sess.) for report of Chief of Engineers dated February 27, 1940, containing a general plan for improvement of the Mississippi River between Coon Rapids Dam and the mouth of the Ohio River for purposes of navigation, power development, the control of floods, and the needs of irrigation.

Terminal facilities.—Most of the water terminal and transfer facilities of the district are described in volumes 1 and 4 of the four-volume report of the Board of Engineers for Rivers and Harbors, entitled "Survey of Terminals and Landings on the Inland Waterways of the United States."

Operations and results during fiscal year.—River stages were favorable to construction work by contract and by hired labor with Government plant the entire year, except during July 1947 and March and April 1948. Regulating works were maintained and project dimensions of channels were secured by dredging. The dis-

tricts standard specifications for construction work were used. Location, quantities, and costs of open river regulating works follow:

Class of work and locality	Miles above	Dikes (hurdles)			
Class of work and locality	mouth of Ohlo River	Number	Linear feet	Cost	
New work by contract: Dogtooth Bend Goose Island Schenlmann-Hanging Dog Island-Grand Tower Island Chester-Ste. Genevieve, Mo Ste. Genevieve, Mo	57-60 111-125 116-119	1 4 7 5	1, 970 1, 740 2, 035 5, 220 3, 230	\$86, 282, 31 91, 170, 04 182, 889, 41 256, 605, 67 204, 132, 04	
Total		2!	14, 195	821, 080, 37	
New work by United States plant and hired labor: Cornice Island	148.3	1	500	28, 819, 97	
Maintenance by United States plant and hired labor.	*****		7, 800	1 290, 611. 21	

<sup>1</sup> Includes cost of screening 7,790 linear feet of dikes with mattress lumber.

and the second s							
Class of work and locality	Miles above mouth of		Linear		es (100 e feet)	T'oo piles	Cost
	Qhio River	Number		Mat- tress	Paving	bank protec- tion	
New work by contract: Dogtooth Bend	24	1	885	885	610		\$62, 017. 95
Maintenance by United States plant and hired labor			12,021	1, 406	4,096	3, 385	198, 182. 34

New work: One dike, totaling 500 feet in length, was built by hired labor with Government plant, as a cost of \$28,819.97. A total of 72,022 cubic yards of material was handled by a United States hydraulic dredge in preparing one locality for new regulating works at a cost of \$5,674.83. Cost of model studies by hired labor amounted to \$11,509.94. Twenty-one dikes, totaling 14,195 feet in length, were built under contract at a cost of \$821,080.37. One revetment, consisting of 885 squares of mattress and 610 squares of paving was completed under contract at a cost of \$62,017.95. In addition to completed work there were under construction by contract, 8 dikes to total about 3,935 linear feet. Costs of \$4,865,228.52 were incurred on the improvement at Chain of Rocks as follows: By contract, construction of lock, \$3,326,934.25; construction of bridge over canal, \$1,256,971.90; relocation of utilities, \$202,349.10; abstract of titles, (includes \$9,946.10 transferred from hired labor) \$10,998.94; appraisals, \$2,662.54; and design of bridge, \$2,479.79. By hired labor, advance planning, \$44,043.06; engineering, designs and estimates, \$18,525.73; purchase of 137.54 acres of land (minus sale of structures), \$17,773.20; appraisals and negotiations, \$2,324.74; abstracts of title to land, (minus) \$9,946.10; legal and administrative expense, \$4,592.71; miscellaneous office and field costs in connection with land acquisition, \$4,275.80; miscellaneous

construction surveys, \$34,508.80; model studies, \$1,258.64; and design of lock and bridge, while under construction, \$31,319.73 and \$4,155.69, respectively. The total cost of new work was \$5,794,-331.58.

Maintenance: Dikes and revetments were repaired at a cost of \$488,793.55. The required 9-foot channel was maintained by four United States hydraulic dredges. During the year 41 shoals developed, of which 36 were dredged once, 2 were dredged twice and one was dredged three times. There were 4,671,597 cubic yards of sand and gravel removed by these dredges from the channel through 21 bars; 143,217 cubic yards of material were removed in outside-the-channel dredging at a cost of \$23,443.73. The channels dredged had a combined length of 22.6 miles, an average width of 303 feet, and an average gain in depth of 5.8 feet. The total cost of maintenance dredging was \$479,259.87.

Hydrographic surveys were made covering 75 miles of river, costing \$36,514.87. Aids to navigation were installed at a cost of \$29,966.38. Other miscellaneous costs were: Snagging, \$24,183.88; cooperative stream gaging, \$8,109.89; discharge observations at miscellaneous localities, \$1,667.03; stream flow forecasting, \$4,545.38; gages, \$14,491.25; and releasing grounded vessels, \$3,766.09; all charged to maintenance. The total cost of all maintenance was

**\$1,091,293.19.** 

The total expenditures under this project were \$6,135,389.52

from regular funds.

Condition at end of fiscal year.—Work under this project (including the authorized Chain of Rocks improvement), is about 51 percent complete. The quantities required to complete the project are estimated at 140 dikes, 145,000 linear feet; 81 revetments, 84,000 linear feet; and the canal, lock, levees, etc., at Chain of Rocks, as recommended in House Document 231. Dikes and revetments are now in good repair and the channel has been greatly improved by the work that has been done. Dredging is required at low stages to remove temporary shoals and maintain the required channel depths.

In recent years, the project dimensions of channels have generally been maintained throughout the navigation season. The navigation season formerly extended from the middle of February to the middle of December, the river being generally closed by ice the remainder of the year. However, in recent years navigation has continued throughout the winter, except when the river is actually blocked by running ice or gorges. The river is generally above the 10-foot stage, St. Louis gage, for 6 months of the year, latter part of February to latter part of August, during which time project channel depths generally prevail without dredging. The mean stage of the river for the fiscal year 1947 was 12.42 feet, St. Louis gage. The mean stage of the river for the fiscal year 1948 was 9.45 feet.

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The following table gives condition of channel during the fiscal year 1948:

	Channel affording—1									
Section	Length of section	9 feet or more		Less than 9 feet		7 feet or less		6 feet or less		Con- trol- ing depth
		Length	Period	Length	Period	Length	Period	Length	Period	
Ohio River to Com-	Miles 32.7	Miles 32, 7	Days 364	Miles 0, 2	Days 1	Miles 0	Days 0	Miles 0	Daye 0	Feet 8.0
Commercial Point to	6.7	6. 7	361	.1	4	0	0	0	0	8.0
Commerce to Grays Point. Grays Point to	6.6	6.6	365		0	0	0	0	0	11.0
Grand Tower	33.7	33, 7	364	.1	1	0	υ	0	0	8.0
Gage Fort Gage to Little	30.3	38. 3	362	. 2	2	,1	1	0	0	7.0
Rock Little Rock to River	9, 5	9. 5	359	.3	6	0	0	0	0	8,0
des Peres	46. 5	46, 5	359	.6	6	0	0	0	0	8.0
Merchants Bridge . Merchants Bridge to northern bounda-	11, 2	11.2	363	.1	2	0	0	0	0	7.5
ry, City of St. Louis !	8.0	7.9	335	. 3	30	.1	1,6	0	0	- 6, 8
to mouth of Missouri River	3.8	3.8	363	. 2	2	a	o	o	0	8. 5

Project width is 300 feet from Ohio River to northern boundary of St. Louis and 200 feet from that point to Missouri River, with additional width in bends throughout.
 This is known as the Chain of Rocks Reach.

The costs and expenditures under the existing project to June 30, 1948, have been as follows:

		Expenditures		
Kind of funds	New work	Maintenance	Total	
Regular Public Works Emergency Relief	\$42, 407, 408. 80 3, 462, 154. 46 996, 747. 95	\$30, 345, 696. 05	\$72, 753, 104, 85 3, 462, 154, 46 996, 747, 95	\$72, 130, 629. 84 3, 462, 154, 46 996, 747. 95
Total	46, 866, 311. 21	33, 345, 696. 05	77, 212, 007, 26	76, 595, 532. 25

Proposed operations.—The balance unexpended June 30, 1948, \$1,847,328.52, plus \$9,860,000 allotted in July 1948, a total of \$11,-707,328.52 will be applied as follows:

01

101,020.02 Will be applied as lollows.	
Accounts payable, June 30, 1948	\$616,475.
Regulating works:	
By contract (completion of existing contract)	
July 1, 1948 to Sept. 9, 1948:	
Piling dikes:	
Schenimann-Hanging Dog Island-	
Grand Tower Island \$1	.51 , 720
By contract, July 1, 1948 to June 30, 1949:	
Piling dikes:	
Cairo Protection 1	.54,000
Crain Island	74,000
Chester 1	20,000
	•

_		_	
-	-	Λ	n
	-	8 1	
- 1	7.0		

New work—Continued		
Bank protection:	-	
Cape Girardeau Wilkinson	42,000	
Wilkinson	105,000	
Chain of Rocks Improvement:		
Bridge over highway (U. S. No. 66):		
Continuing contract:		
July 1, 1948 to Nov. 8, 1948 Lock, continuing contract:	192,534	
July 1, 1948 to June 30, 1949	e 900 000	
Utilities, relocation of 54-inch water line, continuing	0,800,000	
contract:		
Sept. 1, 1948 to May 31, 1949	555,000	
Utilities, payment to East St., Louis and Interurban	000,000	
Water Co for purchase of 2 water lines:	•	•
July 15, 1948	195,000	
Relocation of roads and utilities:		
Jan. 1, 1949 to June 1, 1949	165,000	
Power control and lighting, continuing contract:		
Oct. 1, 1948 to June 30, 1949	200,000	
Construction of canal and levees, continuing contract:		
Nov. 15, 1948 to June 30, 1949	1 100 000	
By hired labor with United States plant:	1,100,000	
Complete land acquisition:	•	•
July 1, 1948 to Dec. 1, 1948	574 700	
Construction surveys:	•	
July 1, 1948 to June 30, 1949	62 500	
Advance planning:	-	
July 1, 1948 to June 30, 1949	72.286	
	•	
Total for new work		10,163,830.
Maintenance:		
By hired labor with United States plant, July 1		
By hired labor with United States plant, July 1, 1948 to June 30, 1949:	222 242	
By hired labor with United States plant, July 1, 1948 to June 30, 1949:  Dikes and bank protection	222,000	
By hired labor with United States plant, July 1, 1948 to June 30, 1949:  Dikes and bank protection  Project channel dredging	559 000	
By hired labor with United States plant, July 1, 1948 to June 30, 1949:  Dikes and bank protection  Project channel dredging  Surveys, gages, and studies	559,000	
By hired labor with United States plant, July 1, 1948 to June 30, 1949:  Dikes and bank protection  Project channel dredging  Surveys, gages, and studies  Aids to navigation	559,000 65,000 30,500	
By hired labor with United States plant, July 1, 1948 to June 30, 1949:  Dikes and bank protection  Project channel dredging  Surveys, gages, and studies  Aids to navigation  Snagging	559,000 65,000 30,500 20,000	
By hired labor with United States plant, July 1, 1948 to June 30, 1949:  Dikes and bank protection  Project channel dredging  Surveys, gages, and studies  Aids to navigation  Snagging  Cooperative stream gaging	559,000 65,000 30,500 20,000	
By hired labor with United States plant, July 1, 1948 to June 30, 1949:  Dikes and bank protection  Project channel dredging  Surveys, gages, and studies  Aids to navigation  Snagging  Cooperative stream gaging  Discharge observations	559,000 65,000 30,500 20,000 18,000 3,000	•
By hired labor with United States plant, July 1, 1948 to June 30, 1949: Dikes and bank protection Project channel dredging Surveys, gages, and studies Aids to navigation Snagging Cooperative stream gaging Discharge observations Stream flow forecasting	559,000 65,000 30,500 20,000 18,000 3,000 8,000	
By hired labor with United States plant, July 1, 1948 to June 30, 1949:  Dikes and bank protection Project channel dredging Surveys, gages, and studies Aids to navigation Snagging Cooperative stream gaging Discharge observations Stream flow forecasting Total maintenance	559,000 65,000 30,500 20,000 18,000 3,000 8,000	925 500 (
By hired labor with United States plant, July 1, 1948 to June 30, 1949: Dikes and bank protection Project channel dredging Surveys, gages, and studies Aids to navigation Snagging Cooperative stream gaging Discharge observations Stream flow forecasting	559,000 65,000 30,500 20,000 18,000 3,000 8,000	925 500 (
By hired labor with United States plant, July 1, 1948 to June 30, 1949:  Dikes and bank protection Project channel dredging Surveys, gages, and studies Aids to navigation Snagging Cooperative stream gaging Discharge observations Stream flow forecasting Total maintenance Unallocated balance	559,000 65,000 30,500 20,000 18,000 3,000 8,000	925,500. 1,523.
By hired labor with United States plant, July 1, 1948 to June 30, 1949:  Dikes and bank protection Project channel dredging Surveys, gages, and studies Aids to navigation Snagging Cooperative stream gaging Discharge observations Stream flow forecasting Total maintenance	559,000 65,000 30,500 20,000 18,000 3,000 8,000	925,500. 1,523,
By hired labor with United States plant, July 1, 1948 to June 30, 1949:     Dikes and bank protection     Project channel dredging     Surveys, gages, and studies     Aids to navigation     Snagging     Cooperative stream gaging     Discharge observations     Stream flow forecasting  Total maintenance     Unallocated balance  Total for all work	559,000 65,000 30,500 20,000 18,000 3,000 8,000	925,500. 1,523. 1,707,328.
By hired labor with United States plant, July 1, 1948 to June 30, 1949:     Dikes and bank protection     Project channel dredging     Surveys, gages, and studies     Aids to navigation     Snagging     Cooperative stream gaging     Discharge observations     Stream flow forecasting  Total maintenance     Unallocated balance  Total for all work  The sum of \$17,500,000 can be profitably	559,000 65,000 30,500 20,000 18,000 3,000 8,000	925,500. 1,523. 1,707,328.
By hired labor with United States plant, July 1, 1948 to June 30, 1949:    Dikes and bank protection    Project channel dredging    Surveys, gages, and studies    Aids to navigation    Snagging    Cooperative stream gaging    Discharge observations    Stream flow forecasting  Total maintenance    Unallocated balance	559,000 65,000 30,500 20,000 18,000 3,000 8,000	925,500. 1,523. 1,707,328.
By hired labor with United States plant, July 1, 1948 to June 30, 1949:     Dikes and bank protection     Project channel dredging     Surveys, gages, and studies     Aids to navigation     Snagging     Cooperative stream gaging     Discharge observations     Stream flow forecasting  Total maintenance     Unallocated balance  Total for all work  The sum of \$17,500,000 can be profitably fiscal year 1950, as follows:	559,000 65,000 30,500 20,000 18,000 3,000 8,000	925,500. 1,523. 1,707,328.
By hired labor with United States plant, July 1, 1948 to June 30, 1949:     Dikes and bank protection     Project channel dredging     Surveys, gages, and studies     Aids to navigation     Snagging     Cooperative stream gaging     Discharge observations     Stream flow forecasting  Total maintenance     Unallocated balance  Total for all work  The sum of \$17,500,000 can be profitably fiscal year 1950, as follows:  New work:	559,000 65,000 30,500 20,000 18,000 3,000 8,000	925,500. 1,523. 1,707,328.
By hired labor with United States plant, July 1, 1948 to June 30, 1949:     Dikes and bank protection     Project channel dredging     Surveys, gages, and studies     Aids to navigation     Snagging     Cooperative stream gaging     Discharge observations     Stream flow forecasting  Total maintenance     Unallocated balance  Total for all work  The sum of \$17,500,000 can be profitably fiscal year 1950, as follows:  New work:     By contract, July 1, 1949 to June 30, 1950:	559,000 65,000 30,500 20,000 18,000 3,000 8,000	925,500. 1,523. 1,707,328.
By hired labor with United States plant, July 1, 1948 to June 30, 1949:     Dikes and bank protection     Project channel dredging     Surveys, gages, and studies     Aids to navigation     Snagging     Cooperative stream gaging     Discharge observations     Stream flow forecasting  Total maintenance     Unallocated balance  Total for all work  The sum of \$17,500,000 can be profitably fiscal year 1950, as follows:  New work:     By contract, July 1, 1949 to June 30, 1950:     Chain of Rocks improvement:	559,000 65,000 30,500 20,000 18,000 8,000	925,500, 1,523, 1,707,328, during th
By hired labor with United States plant, July 1, 1948 to June 30, 1949:     Dikes and bank protection     Project channel dredging     Surveys, gages, and studies     Aids to navigation     Snagging     Cooperative stream gaging     Discharge observations     Stream flow forecasting  Total maintenance     Unallocated balance  Total for all work  The sum of \$17,500,000 can be profitably fiscal year 1950, as follows:  New work:     By contract, July 1, 1949 to June 30, 1950:     Chain of Rocks improvement:     Construction of lock	559,000 65,000 30,500 20,000 18,000 3,000 8,000 	925,500. 1,523. 1,707,328. during th
By hired labor with United States plant, July 1, 1948 to June 30, 1949:     Dikes and bank protection     Project channel dredging     Surveys, gages, and studies     Aids to navigation     Snagging     Cooperative stream gaging     Discharge observations     Stream flow forecasting  Total maintenance     Unallocated balance  Total for all work  The sum of \$17,500,000 can be profitably fiscal year 1950, as follows:  New work:     By contract, July 1, 1949 to June 30, 1950:     Chain of Rocks improvement:	559,000 65,000 30,500 20,000 18,000 3,000 8,000 	925,500. 1,523. 1,707,328. during the
By hired labor with United States plant, July 1, 1948 to June 30, 1949:     Dikes and bank protection     Project channel dredging     Surveys, gages, and studies     Aids to navigation     Snagging     Cooperative stream gaging     Discharge observations     Stream flow forecasting  Total maintenance     Unallocated balance      Total for all work  The sum of \$17,500,000 can be profitably fiscal year 1950, as follows:  New work:     By contract, July 1, 1949 to June 30, 1950:         Chain of Rocks improvement:         Construction of lock         Construction of canal and levees         Power control and lighting	559,000 65,000 30,500 20,000 18,000 3,000 8,000 	925,500. 1,523. 1,707,328. during the
By hired labor with United States plant, July 1, 1948 to June 30, 1949:     Dikes and bank protection     Project channel dredging     Surveys, gages, and studies     Aids to navigation     Snagging     Cooperative stream gaging     Discharge observations     Stream flow forecasting  Total maintenance     Unallocated balance  Total for all work  The sum of \$17,500,000 can be profitably fiscal year 1950, as follows:  New work:     By contract, July 1, 1949 to June 30, 1950:     Chain of Rocks improvement:	559,000 65,000 30,500 20,000 18,000 3,000 8,000 	925,500, 1,523, 1,707,328, during th
By hired labor with United States plant, July 1, 1948 to June 30, 1949:     Dikes and bank protection     Project channel dredging     Surveys, gages, and studies     Aids to navigation     Snagging     Cooperative stream gaging     Discharge observations     Stream flow forecasting  Total maintenance     Unallocated balance  Total for all work  The sum of \$17,500,000 can be profitably fiscal year 1950, as follows:  New work:     By contract, July 1, 1949 to June 30, 1950:     Chain of Rocks improvement:	559,000 65,000 30,500 20,000 18,000 3,000 8,000 	925,500. 1,523. 1,707,328. during the
By hired labor with United States plant, July 1, 1948 to June 30, 1949:     Dikes and bank protection     Project channel dredging     Surveys, gages, and studies     Aids to navigation     Snagging     Cooperative stream gaging     Discharge observations     Stream flow forecasting  Total maintenance     Unallocated balance  Total for all work  The sum of \$17,500,000 can be profitably fiscal year 1950, as follows:  New work:     By contract, July 1, 1949 to June 30, 1950:     Chain of Rocks improvement:         Construction of lock         Construction of canal and levees         Power control and lighting  Regulating works, by contract:     Dikes     Bank protection By hired labor with United States plant:	559,000 65,000 30,500 20,000 18,000 3,000 8,000 	925,500. 1,523. 1,707,328. during the
By hired labor with United States plant, July 1, 1948 to June 30, 1949:     Dikes and bank protection     Project channel dredging     Surveys, gages, and studies     Aids to navigation     Snagging     Cooperative stream gaging     Discharge observations     Stream flow forecasting  Total maintenance     Unallocated balance  Total for all work  The sum of \$17,500,000 can be profitably fiscal year 1950, as follows:  New work:     By contract, July 1, 1949 to June 30, 1950:     Chain of Rocks improvement:	559,000 65,000 30,500 20,000 18,000 3,000 8,000 	925,500. 1,523. 1,707,328. during the
By hired labor with United States plant, July 1, 1948 to June 30, 1949:     Dikes and bank protection     Project channel dredging     Surveys, gages, and studies     Aids to navigation     Snagging     Cooperative stream gaging     Discharge observations     Stream flow forecasting  Total maintenance     Unallocated balance  Total for all work  The sum of \$17,500,000 can be profitably fiscal year 1950, as follows:  New work:     By contract, July 1, 1949 to June 30, 1950:         Chain of Rocks improvement:	559,000 65,000 30,500 20,000 18,000 3,000 8,000 	925,500. 1,523. 1,707,328. during the
By hired labor with United States plant, July 1, 1948 to June 30, 1949:     Dikes and bank protection     Project channel dredging     Surveys, gages, and studies     Aids to navigation     Snagging     Cooperative stream gaging     Discharge observations     Stream flow forecasting  Total maintenance     Unallocated balance  Total for all work  The sum of \$17,500,000 can be profitably fiscal year 1950, as follows:  New work:     By contract, July 1, 1949 to June 30, 1950:     Chain of Rocks improvement:	559,000 65,000 30,500 20,000 18,000 3,000 8,000 	925,500.0 1,523.0 11,707,328.0 during the

#### 1510 REPORT OF CHIEF OF ENGINEERS, U. S. ARMY, 1948 Maintenance: By hired labor with United States plant: Dikes and bank protection 470,000 574,000 Project channel dredging Surveys, gages, and studies 95,000 Aids to navigation 45,000 Snagging Cooperative stream gaging 20,000 18,000 Discharge observations Stream flow forecasting 3,000 8,000 Establishment of 3d. order triangulation 67,000 Total maintenance 1,300,000 Total for all work \_\_\_\_\_ 17,500,000 It is expected that with the proposed expenditures, the project (including Chain of Rocks improvement) will be about 78 percent complete. Cost and financial summary Total cost of permanent work to June 30, 1948 \_\_\_\_\_\_\_ 83,889.231.75 Minus accounts payable, June 30, 1948 616,475.01 Net total expenditures 83,272,756.74 Unexpended balance, June 30, 1948 1,847,828.52 Total amount appropriated to June 30, 1948 185,120,085.26 83,272,756.74 1,847,328.52 Fiscal year ending June 30 1944 1945 1946 1947 1948 \$499, 208, 64 1, 212, 468, 36 \$643, 637, 88 978, 187, 54 Cost of new work. Cost of maintenance. \$1,546,976.35 903,858.93 \$2,026,078,17 \$5, 794, 331, 58 735, 730, 45 1,091,298,19 Total cost 1,711,677,00 1,621,825.42 2, 450, 835. 28 2, 761, 808. 62 6, 885, 629, 77 1, 215, 608, 81 1,749, 137, 27 2, 553, 928, 39 2, 678, 477, 94 6, 135, 389, 52 -450, coo. oo 3, 800, ooo. oo 4, 507, 000, 00 788, 000, 00 5, 527, 000, 00 Balance unexpended, July 1, 1947\_\_\_\_\_\_\_Amount allotted during fiscal year\_\_\_\_\_\_ \$2,455,718.04 5,527,000.00 Amount to be accounted for \$6,136,706.02 7,982,718.04 Less reimbursed expenditures 1,316.50 6,135,389,52 Balance unexpended, June 30, 1948 Outstanding liabilities, June 30, 1948 1,847,328.52 616,475.01 Amount covered by uncompleted contracts\_\_ 1,165,211.37 1,781,686.38 Balance available, June 30, 1948\_\_\_\_\_Amount allotted in July 1948\_\_\_\_\_ 65,642.14 9,860,000.00 Unobligated balance available for fiscal year 1949 9,925,642.14 Amount (estimated) required to be appropriated for completion of existing project 36,141,500.00 Amount that can be profitably expended in fiscal year ending June 30, 1950: For new work 16,200,000.00 For maintenance 1,300,000.00 Total\_\_\_\_ 17,500,000.00 <sup>1</sup> Includes \$5,260,604.83 from permanent indefinite appropriation covering snagging operation, of which 280,572.72 pertained to Vicksburg and Memphis districts.

	Flood ControlContinued	Рвде	1	Flood Cantrol—Continued	<b>D</b>
21.		-		Public Law 75, Seventy-	Page
22.	district No. 3, Illinois Wilson and Wenkel and	1383		ninth Congress, and Public Law 102, Eightieth Con-	
	Prairie du Pont drainage		1	gress	1395
434)	and levee districts, Illinois	1385	29.	Emergency protection for cer-	
23.		1000	1	tain highway and railroad	
24.	Illinois. Chouteau, Nameoki, and	1387		facilities from flood damage	
4ª.	Venice drainage and levee		ĺ	in the vicinity of Price	
	district, Illinois	1000	Į	Landing, Mo. (section 12,	
25.	Wood River drainage and	1389		Flood Control Act ap-	
20.	levee district, Illinois	1000	00	proved Dec. 22, 1944)	1396
26.	Upper Missisippi River Ba-	1390	30.	Preliminary examinations,	
۵0.	sin, St. Louis district	1000		surveys, and contingencies	
27.	Emergency flood-control	1392	61	for flood control	1397
₩1.	work under authority of		31.	Snagging and clearing under	
	the Flood Control Act			authority of section 2 of	
	nonworld August 19 1041	1004		the Flood Control Act ap-	
28.	approved August 18, 1941 Emergency flood-control	1394		proved August 28, 1937, as	4000
20.	work under outherity of	- 1	òο	amended	1397
	work under authority of Public Laws 138 and 318,	j	32.	Inactive flood-control proj-	*000
	Soventy eighth Congress	}		ects	1398
	Seventy-eighth Congress,	i			

#### 1. MISSISSIPPI RIVER BETWEEN THE OHIO AND MISSOURI RIVERS

Location.—The Mississippi River rises in Lake Itasca, Minn., and, from that lake flows in a southerly direction about 2,350 miles and empties into the Gulf of Mexico. The portion included in this report embraces the 195-mile section known as the middle Mississippi, between the tributary Ohio and Missouri Rivers, about 984 to 1,179 miles from the Gulf.

Previous projects.—The original project for the improvement of the Mississippi River between the Ohio and Missouri Rivers was recommended by a board of engineers in a report, dated April 13, 1872, and concurred in by the Chief of Engineers. For further details see page 1879 of the Annual Report for 1915 and

page 1014 of the Annual Report for 1938.

Existing project.—This provides for obtaining and maintaining a minimum channel depth of not less than 9 feet, a minimum width of not less than 300 feet at low water, with additional width in bends from the mouth of the Ohio River (about 984 miles from the Gulf) to the northern boundary of the city of St. Louis, 191 miles; thence 200 feet wide, with additional width in bends to the mouth of the Missouri River, 4 miles; to be obtained: First, by regulating works, for closing sloughs and secondary channels, and narrowing the river; by building new banks where the natural width is excessive and protecting new and old banks from erosion where necessary to secure permanency; second, by dredging or other temporary expedients to maintain channels of project dimensions; third, by construction of works authorized for the Chain of Rocks reach in the River and Harbor Act of March 2, 1945, which approved a comprehensive plan for development of the Mississippi River at Chain of Rocks so as to provide for construction of a lateral canal at an estimated first cost to the United States of approximately \$10,290,000, with annual maintenance and operation cost of \$70,000, subject to such modification as the Chief of Engineers may find necessary when the project is under-

taken; and to authorize the relocation of the river channel and reclamation of the area in Sawyer Bend for airport, park, recreational, and similar purposes at a cost to local interests of approximately \$17,555,000; provided that any modification of the present river channel required by the civic development be deferred until completion of the lateral canal in the interest of navigation and that the river diversion work connected with such civic development be under the supervision of the Chief of Engineers in order to insure that the interests of interstate and foreign commerce be properly protected; and further provided that local interests hold and save the United States free from any claims for damages that might be incurred due to the construction, maintenance, or operation of such civic development or any part thereof (H. Doc. 231, 76th Cong., 1st sess.).

The estimated cost of new work, revised in 1949, is \$93,173,000.

with \$1,370,000 for annual maintenance.

The existing project was authorized by the following river and harbor acts:

Acts	Work authorized	Documents		
June 3, 1896	Project for regulating works adopted in 1881. (To obtain a minimum depth of 8 feet.)	Annual Report, 1881, p. 1536.		
June 13, 1902 Mar. 2, 1907	Dredging introduced as part of the project			
Mar. 3, 1905 1 Mar. 2, 1907 1	These acts practically abrogated that part of the project for the middle Mississippi which proposed regulating works.			
June 25, 1910	Regulating works restored to the project and appropriations begun with a view to the completion of the improvement between the Ohio and Missouri Rivers within 12 years at an estimated cost of \$21,000,000, exclusive of amounts previously expended.	H. Doc. 50, 61st Cong., 1st sess., and H. Doc. 168, 58th Cong., 2d sess.		
Jan. 21, 1927	For a depth of 9 feet and width of 300 feet from the Ohio River to the northern boundary of the city of St. Louis, with the estimated cost of maintenance increased to \$900,000 annually.	Rivers and Harbors Committee Doc. 9, 69th Cong., 2d sess.		
July 3, 1930	Project between the northern boundary of the city of St. Louis and Grafton (mouth of Illinois River) modified to provide for a channel 9 feet deep and generally 200 feet wide with additional width around bends, at an estimated cost of \$1,500,000, with \$125,000 annually for maintenance.	Rivers and Harbors Committee Doc. 12, 70th Cong., 1st sess.		
Mar. 2, 1945	Modified to provide for construction of a lateral canal with lock at Chain of Rocks, at an estimated first cost to the United States of about \$10,290,000, with \$70,000 annually for maintenance and operation.	H. Doc. 231, 76th Cong., 1st sess.		

Also joint resolution, June 29, 1906.

See House Document 669 (76th Cong., 3d sess.) for report of Chief of Engineers dated February 27, 1940, containing a general plan for improvement of the Mississippi River between Coon Rapids Dam and the mouth of the Ohio River for purposes of navigation, power development, the control of floods, and the needs of irrigation.

Terminal facilities.—Most of the water terminal and transfer facilities of the district are described in volumes 1 and 4 of the four-volume report of the Board of Engineers for Rivers and Harbors, entitled "Survey of Terminals and Landings on the Inland Waterways of the United States."

### 1356 REPORT OF CHIEF OF ENGINEERS, U. S. ARMY, 1949

Operations and results during fiscal year.—River stages were favorable to construction work by contract and by hired labor with Government plant during the fall of 1948 but were unfavorable during the spring of 1949, work being carried on only intermittently. Regulating works were maintained and project dimensions of channels were secured by dredging. Location, quantities, and costs of open river regulating works were as follows:

شها ووالومقط فالأوا والمواديقة المحاصورين فيالمواد فالمحاصور والمحاصورين والمتوادية	7	·			
Clear of made and L. W.	Miles above	Dikes (hurdles)			
Class of work and locality	of Ohio River	Number	Linear feet	Cost	
New work by contract: Cairo protection. Schenimann — Hanging Dog Island — Grand	6-8	6	2185	\$148, 392. 27	
Tower Island	57-83 103-116	10 10	3910 -51 <b>4</b> 5	150, 315, 50 302, 770, 01	
Total	=	26	11240	601, 477, 78	
Maintenance by United States plant and hired labor:			8710	1 286, 932, 30	
Maintenance by United States plant and hired labor:	=	26			

Includes cost of screening 9,460 linear feet of dikes with mattress lumber.

		Bunk protection (revetment)					
Class of work and locality	Miles above mouth of Ohio River	above mouth of Ohio	feet squ		Squares (100 square feet)		Cost
				Mat- tress	Paving	bank protec- tion	
New work by contract: Cape (lirardeau-Wilkinson	47-94	2	2, 058	2, 055	861		\$92, 643. 22
Maintenance by United States plant and hired labor			1, 635	164	699	450	34, 043. 40

New work: A total of 24,249 cubic yards of material was handled by a United States hydraulic dredge in preparing one locality for new regulating works at a cost of \$9,817.32. Twentysix dikes, totaling 11,240 feet in length, were built under contract at a cost of \$601,477.01. Two revetments, consisting of 2,055 squares of mattress and 861 squares of paving, were completed under contract at a cost of \$92,643.22. Costs of \$5,996,995.36 were incurred on the improvement at Chain of Rocks as follows: By contract, construction of lock, \$5,265,333.37; construction of bridge over canal, \$176,795.42; relocation of utilities, \$245,252.01; advance planning, \$709.70; abstracts of title to land, \$421.37; and construction of canal and levees, \$915.56. By hired labor, advance planning, \$108,810.80; abstracts of title to land, legal and administrative expense and appraisals and negotiations, \$30,631.43; purchase of 387.47 acres of land (minus sale of structures), \$67,747.64; design of bridge, \$1,878.29; design of lock, \$42,916.55; miscellaneous construction surveys, \$35,621.83; model studies, \$18,881.55; and design of power control and lighting, \$1,079.84.

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The total cost of new work was \$6,700,933.68, of which \$307,567.93

was by hired labor.

Maintenance: Dikes and revetments were repaired at a cost of \$319,975.70. The required 9-foot channel was maintained by three United States hydraulic dredges. During the year 41 shoals developed, of which 37 were dredged once and 2 were dredged twice, removing 3,910,501 cubic yards of sand and gravel from the channel at a cost of \$456,558.62. The channels dredged had a combined length of 22.8 miles, an average width of 280 feet, and

an average gain in depth of 5.9 feet.

Hydrographic surveys were made covering 65 miles of river, costing \$32,230.26, of which \$3,686.54 was by contract. Aids to navigation were installed at a cost of \$37,377.67. Other miscellaneous costs were: Snagging, \$13,731.63; cooperative stream gaging, \$8,969.84; discharge observations at miscellaneous localities, \$991.28; stream flow forecasting, \$4,890.05; gages, \$15,-974.48; and releasing grounded vessels, \$2,185.16; all charged to maintenance. The total cost of all maintenance was \$892,884.69. The total costs for the fiscal year were \$7,593,818.37 and the expenditures were \$7,089,899.37, all from regular funds.

Condition at end of fiscal year.—Work under this project (including the Chain of Rocks canal), is about 57 percent complete. The quantities required to complete the project are estimated at 133,760 linear feet of dikes, 66,135 linear feet of revetment, 607,000 cubic yards of construction dredging, 270,000 cubic yards of rock removal, and the canal, locks, levees, etc., at Chain of Rocks, as authorized by the River and Harbor Act of March 2, 1945. Dikes and revetments are now in good repair and the channel has been greatly improved by the work that has been done. Dredging is required at low stages to remove temporary shoals and maintain

the required channel depths.

In recent years, the project dimensions of channel have generally been maintained throughout the navigation season. The navigation season formerly extended from the middle of February to the middle of December, the river being generally closed by ice the remainder of the year. However, in recent years increased demands of commerce and more general use of steel-hull boats have combined to extend the navigation season throughout the year except when blocked by heavy running ice or gorges. The river is generally above the 10-foot stage, St. Louis gage, for 6 months of the year, latter part of February to latter part of August, during which time project channel depths generally prevail without dredging. The mean stage of the river, St. Louis gage, was 9.45 feet for the fiscal year 1948 and 9.25 feet for the fiscal year 19**49**.

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The following table gives condition of channel during the fiscal year 1949:

نها والكام والمراجع والمالية المالية والمساور والمالية					• • •					
		Channel affording1								
Section	Length of sec- tion			Less than 9 feet		7 feet or less		6 feet or less		Con- trol- ling
		Length	Period	Length	Period	Length	Period	Longth	Period	depth
ar branch	Miles	Miles	Days	Miles	Days	Miles	Days	Miles	Days	Feet
Ohio River to Com- mercial Point Commercial Point to	32, 7	32. 7	365	0	Q	0	0	0	0	9.5
Commerce to Grays	6.7	6.7	364	.1	1	0	0	0-	0	8. 0
Point	6.6	6. 6	365	0	0	0	0	O	0	10. 5
Orand Tower Orand Tower to Fort	33, 7	33. 7	365	ø	0	0	o	0	0	9.0
Clage Fort Clage to Little	36. 3	36, 3	362	, 2	3	0	0.	0	0	8.0
Rock.	9, 5	9. 5	363	.1	2	e	0	-0	0	8. 5
des Peres	46. 5	40, 5	362	. 2	7	0	0	0	O.	8.0
Merchants Bridge. Merchants Bridge to	11, 2	11.2	356	2	9	o.	0	0	0	8,0
northern bounda- ry, city of St. Louis <sup>2</sup>	8.0	8.0	302	.4	63	. 2	10	. 2	1	5. 9
to mouth of Mis- souri River 2	3.8	3, 8	365	0	0	0	0	0	0	9, 0

<sup>&</sup>lt;sup>1</sup> Project width is 300 feet from Ohio River to northern boundary of St. Louis and 200 feet from that point to Missouri River, with additional width in bends throughout.<sup>1</sup>
<sup>1</sup> This is known as the Chain of Rocks Reach.

The costs and expenditures under the existing project to June 30, 1949 have been as follows:

Ph. I. Charles				
Kind of funds	New work	Maintenance	Total	Expenditures
Regular Public Works Emergency Relief	\$49, 108, 342, 48 3, 462, 154, 46 996, 747, 95	\$31, 238, 580. 74	\$50, 346, 923, 22 3, 462, 154, 46 906, 747, 95	\$79, 226, 529. 21 3, 462, 154. 46 996, 747, 95
Total	53, 567, 244. 89	31, 238, 580. 74	84, 805, 825, 63	83, 685, 431. 62

Proposed operations.—The balance unexpended June 30, 1949, \$4,617,429.15 plus \$32,757.45 amount advanced to plant account, plus \$10,725,000 allotted in fiscal year 1950, a total of \$15,375,-186.60, will be applied as follows:

Accounts payable, June 30, 1949	\$1,153,151,46
New work:	
Regulating works:	
By contract:	
Bank protection, July 1949 (completion of existing	
contract), Cape Girardeau-Wilkinson	20.361.00
Piling dikes: July 1949 to June 1950:	•
Powers Island-Schenimann	275,000.00
Fish Bend.	96,000.00

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		MITOTIV	mand of	o. Armi,	1949
New work-Continue	ai .			•	
Regulating works	u				
Des des de la contraction de l	<b>;</b>				
By contract:					
Dikes				104,00	Λ
Bank pr By hired labor wi	otection	• • • • • • •		557 00	
By hired labor wi	th United S	tates plant		557,00	V
					_
Bank protect	ion			60,00	
Bank protect	1011	******		19,50	0
Dredging				109,500	000,000
Total for n				· ·	10,850,000
Malana a	ew work				10 .850 .000
Maintenance:			*		20,000,000
By hired labor wit	th United S	tates plant.			
INKARDATA	nir namenaki	~ ••		040 204	
				340,500	<b>)</b>
Surveys, gage	a and stud	00		378,500	
Aids to naviga	o, and stud	168		95,000	
				45,000	
Snagging Cooperative s Discharge obs				20,000	•
Cooperative at	tream gagir	Ig		18,000	
Discharge obs	ervations	~ ~		3,000	
				8,000	
Establishment	of 3d orde	r triangulat	ion	67 000	
				67,000	
Total maint Operating and care	enance		_		
Operating and care	Lock 27				975,000
Chain of Rock	g improver	ont			
Chain of Rock Ordinary main	tonanco en	иень		30,000	
Ordinary main	and wasser	repair		7,000	
Improvement	and reconst	ruction		5.000	
Total operat					
/N-4-1 / N		<u> </u>			42,000
Total for all	work				11,867,000
	Cost and	financial a	41.004.00		
Total amount appropriations of new work to Jur	tad ta Tiina	00 1010		1.004	000 00= 04
Cost of new work to Jur	ne 30, 1949	00, 1010		· \$94	,980 ,085 .26
Cost of new work to Jur Cost of maintenance to Total net expenditures to	June 80 19	40		04	,983 ,864 .55
Total net expenditues +	- I 00			'36	.499.185.57
Total net expenditures to Unexpended balance, Just Unobligated balance ava Amount appropriated for	no 20 1040	1949		<sup>1</sup> 90	.862 .656 .11
Unobligated balance ave	ileble Torre	^~~~~~~		4	,617,429.15
Amount appropriated for	nanie, June	30, 1949			. ,
Amount appropriated for Total unobligated beland	r nacai year	ending Jun	e 30, 1950_	10	,725 ,000 .00
Total unobligated balance Estimated additional and	e available	for fiscal ye	ear 1950	10	,725 ,000 .00
Estimated additional an	nount requi	ired to-be	appropriate	d for	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
completion of existing	project			26	391 ,477 . 42
*	<del></del>			20,	1001,211.42
		Fiscal	vous anding T		
		* InCal	year ending Ju	ine 30	
	1045		1	T	i
	1945	1946	1947	1048	1949
A manufacture of			<u></u>		
Appropriated.	\$3, 800, 000, 00	\$4, 507, 000. 00	\$788, non no	\$6 897 000 00	<b>60</b> 000 000 00
Cost of new work. Cost of maintenance	643, 637, 88	1, 548, 976, 35	\$788, 000. 00 2, 026, 078. 17	\$6, 527, 000, 00 5, 794, 331, 58	\$9, 860, 000, 00 6, 700, 933, 68
	978, 187. 54	903, 868. 93	735, 730. 45	1, 091, 298. 19	892, 884. 69
l'otal expended	1, 749, 137, 27	2, 553, 928, 39			
	.,	=, 000, 040. 39	2, 678, 477. 94	6, 135, 389, 52	7, 089, 899, 37

<sup>&</sup>lt;sup>1</sup> Includes \$5,260,604.83 from permanent indefinite appropriation covering anagging operation, of which \$280,572.72 pertained to Vicksburg and Memphis districts.

### 2. MISSISSIPPI RIVER BETWEEN THE MISSOURI RIVER AND MINNE-APOLIS, MINN. (ST. LOUIS DISTRICT)

See report, "Mississippi River between the Missouri River and Minneapolis, Minn.," page 1403.

3. ILLINOIS WATERWAY, ILL. (ST. LOUIS DISTRICT)
See report, "Illinois Waterway, Ill.," page 2051.